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MARKETING INFORMATION SYSTEMS
EVALUATION OF MT SOFTWARE
TERMINOLOGY AND THE COMPUTER

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Evaluation of MT software and methods

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Paper presented at Machine Translation Today, a conference jointly sponsored by Aslib, the Association for Information Management, the Aslib Technical Translation Group, the Institute of Translation and Interpreting, and the European Association of Machine Translation on 18-19 November 1993, at the CBI Conference Centre, London.

Abstract
In this paper we first discuss the wide variety of possible scenarios in which an evaluation may be carried out. On this basis, an attempt is made to pick out some general characteristics relevant to the design of evaluations and the search for a general framework for evaluation methodologies is motivated. Some resources for use in data collection for evaluation purposes are briefly described and discussed, and the work of the EEC EAGLES Evaluation and Assessment Group is summarized.

Introduction

Although the title talks explicitly of machine translation, I hope that much of what is said will apply to the evaluation of language industry products in general: although less ambitious in their aims than systems which aim to produce a draft or finished translation, a growing list of products which can greatly facilitate the translator's task and relieve him of some of its more tedious aspects exists. Amongst the more modest are spelling checkers and automated dictionaries; the range continues through grammar and style checkers and terminology servers to the specialized work stations now being developed, which aim at providing access to previous translations as well as document preparation services specially conceived with the translator in mind.

Evaluation is relevant to all of these, and, from an end-user's point of view, perhaps especially to those which, precisely because they are relatively limited in their aims, rely on a stable linguistic technology and appear in considerable numbers on the market; choosing which spelling checker to buy can require quite a lot of thought.

Evaluation is various

A starting point for thinking about evaluation is to notice how wide is the variety of those who might be interested in evaluating something; there are those who wish to buy a finished product, but tracing the lifetime of that product backwards, there are also those who developed it, those who invested in the development, those who are trying to sell it, as well as those who did the original research and those who funded them for doing it. At the extreme ends of the spectrum, there are the policy makers who decide that now is the moment to invest heavily in a particular line of research, and those who want to decide whether a system that has been installed for some time is really earning its keep.

Another way to look at this variety is to consider what the objects of evaluation might be: if this time we work in the opposite direction, we can distinguish a range going from research proposals, through research (or development) work in progress, through prototype systems intended to demonstrate the validity of the technology underlying them to actual market products or systems that have already been installed. But thought of this way, a quite important point begins to emerge. Except in the case of research proposals or research prototypes, it is quite rare for a system in isolation to be of interest. In most other cases, what has to be evaluated is a system in a context – what Galliers and Sparck Jones[1] call a 'set-up'. A couple of examples will help to make this idea more concrete.

A system which in a single user situation is perfectly acceptable may turn out to be disastrously slow when many users are simultaneously involved. For example, the requirements on a system providing information on railway timetables will be radically different if it is to be accessible to the general public rather than used by an information clerk in the railway travel office. Similarly, there is little point in introducing even a satisfactory machine translation system into a translation service if it requires that the text be typed in and every translator in that service refuses to touch a keyboard. King[2] discusses the particular contexts relevant to a translation service.

Towards generalization

Once we think about all the different kinds of people who might carry out an evaluation, the variety of objects to be evaluated, the range of purposes for which the evaluation might be carried out and the diversity of contexts which might be relevant to the evaluation, it might seem hopeless to try to generalize at all. We can make a start however by thinking first about why people evaluate. Although the borderlines are rarely totally clear, we can distinguish three main reasons.

First, they may evaluate in order to check progress towards a goal: a typical example would be a research worker or a group carrying out development of a system. They have some idea, stated or unstated, about what that system should be able to do. They evaluate their own work in order to discover how far they have progressed towards that goal.

The same group may evaluate their work in order to discover what problems persist and diagnose the reasons behind malfunctioning of the system. Another example of diagnostic evaluation may occur when a potential customer is evaluating a machine translation product: it is quite rare to be able to buy a system off the shelf which does exactly what any given customer requires. (For example, at a simple level, if he or she has specific terminology that should be used with his or her translations, it is unlikely that a general purpose system will already include it). Thus, when evaluating the system, he or she might well be interested in trying to find out what errors can be repaired by modifying the dictionary, what errors would require more extensive work.

The potential customer typically has a set of needs he or she wants a system to fulfil: his or her main reason for evaluating a system will be to find out if the system, once introduced into the foreseen context, will be adequate to those needs.

Essentially, then, we have distinguished three types of evaluation: progress evaluation, diagnostic evaluation and adequacy evaluation.

Once the type of evaluation has been determined, the next stage in designing an evaluation is to decide what dimensions of the system are relevant. Obvious dimensions are things like whether the system does what it is supposed to do, and whether it does it efficiently, but considerations of context can be important here too. For example, a large company considering introducing a machine translation system into a service which already makes substantial use of computing, may be insistent that any candidate system can easily be integrated with the hardware and software platform which already exists.

Having decided what the relevant dimensions are, the next step is to look for criteria which will provide information on how well the system being evaluated performs on that dimension. Let us pause once more here to make things concrete through an example. Let us imagine that we are designing an evaluation for a potential customer of a machine translation system. Since we shall clearly be involved mainly in adequacy evaluation of whether a system meets his or her needs, determining what dimensions are relevant will involve examining these needs very closely. Notice that this can be a long and difficult task, since it involves sorting out from his or her, perhaps naive, perception of his or her needs, and the evaluator's, perhaps misinformed, perception of his or her needs what the real needs actually are. It may even be the case that different parts of the same organization – say the computing service and the translation service – have quite different views of what the real needs are. But let us imagine that this has been done, and we know that one relevant dimension is the efficiency of the system. One possible criterion for efficiency is speed; how long it takes to translate some pre-determined amount of text.

We are now faced with the problem of defining a way in which speed can be measured. A variety of possible measures are conceivable. For example, it is a well known characteristic of machine translation systems that processing speed tends to deteriorate as a function of sentence length. Thus, (I hope this is a caricature), if it takes two seconds to translate a two word sentence, it may take 10 seconds to translate a three word sentence and three hours to translate a thirty word sentence. So let us take just one aspect of our criterion and make it not simply speed, but the speed with which a sentence can be translated. As a measure of this we might imagine taking a text typical of the kind of text we are interested in translating, and choosing from it a set of sentences with length ranging from the shortest we can find in the text to the longest. Thus, if the shortest sentence is three words long and the longest fifty, we will take a three word sentence, and a four word sentence, and a five word sentence, gradually increasing the length up to fifty. (Of course, we might not be able to find a sentence of thirty-seven words, but we will ignore that complication). We can then, as a method for obtaining the relevant data, submit each sentence to the system, discover how long it takes to produce a result for each of our sentences and perhaps plot a graph to show how processing time increases with sentence length.

Unfortunately, the measure we have chosen may not be as straightforward as it first seems. Measures in general should be both valid and reliable; that is, they should measure what they are supposed to measure, and they should do it reliably – we should not get different data on different occasions. The measure we have chosen may not be valid; certain syntactic constructions are typically harder to deal with than others, and their presence in the input may have a direct influence on the processing time. Thus 'Who did John see?' may, for good reasons, take longer to process than 'John saw the dog' despite the fact that both are four words in length, and the longer the sentence, inevitably, the harder it will be to disentangle the effect of length from the effect of different structures. Similarly, the measure may not be reliable. If the system is being used in conjunction with other computing processes, we may get different answers depending on what demands are being made on the computing power available by those other processes. To give a simple example, we would almost certainly get different answers if we ran the test via a windowing interface than if we ran it without one.

There is no space here to discuss in any detail what valid and reliable measures might be, even in the specific case of our chosen example. The important point is that it can take time, care and sometimes considerable imagination to come up with measures that are relevant to the criteria chosen and are also valid and reliable. Similarly, the method used to obtain the data used for measuring must also be valid and reliable; it is no use, for example, taking as a measure the length of time taken to correct a translation via a text processing system on a screen if in some cases the screen has sunshine falling on it and sometimes does not.

To summarize this section: designing an evaluation can be thought of as a top-down process. First the type (or types) of evaluation in question are determined. Secondly, the dimensions relevant to this particular evaluation are defined. Then a set of criteria refining and defining each dimension in more detail are defined, and a set of valid and reliable measures pertinent to each criterion defined. For each measure, a method of obtaining the data relevant to that measure is also defined. The method too must be valid and reliable. King[3] discusses the overall design of evaluations and examines some past evaluations in the light of the design suggested here.

Some more about measures

Before we return to more general questions, it is worth remarking on one further distinction: measures may be qualitative or quantitative. Qualitative measures are those which involve some kind of subjective judgement, as when, perhaps, we want to evaluate the user interface to a system and we simply ask a representative group of people to use the system for a while and then rate the interface on a three point scale as being good, acceptable or bad. Quantitative measures, as the term implies, involve counting something, for example the time from input to output in our previous example. A look at the literature on evaluation will reveal how important it is not to get these mixed up; it is only too easy to give a spurious air of objectivity to what is basically a set of subjective judgements. This is especially true when extraneous factors may influence the judgements made. One anecdote recounts an evaluation where both human and machine produced translations were to be rated. If the human translations were typed and the machine translations printed on a line printer, the human translations were consistently judged to be better than the machine translations. Unfortunately, if the machine translations were typed and the human translations printed, the result was reversed and the machine translations consistently judged to be better – even when the same translations were put up for judgement in the two cases.

This too brings us to a general point, which has already been touched on a little when we were talking about methods; questions of good experimental design are critical to designing a good evaluation. Just as it is of doubtful validity to ask three people whether they prefer black cars or red cars and produce only cars of whichever colour gets most votes, it is not very reliable to base an evaluation of a machine translation system on one person's going to see a demonstration of it. This point, and other related issues, are discussed in detail in Falkedal[4], which contains a valuable critical assessment of some past evaluations.

Towards a general framework

A first motivation for investing effort into trying to define a general framework for evaluation methodologies emerges from what has been said so far: evaluation is difficult. There is a very strong argument for sharing experience, discussing the strengths and weaknesses of different techniques, recognizing and publicizing mistakes, all with the aim of coming to a common understanding of what is involved in designing an evaluation and in carrying it out. Far too often in the past every new evaluator has started from scratch; he has, of course, gone over what is in the literature, examined it critically and then either rejected it or tried to build on it. But until comparatively recently, most evaluations were carried out under contract to a particular organization and the results presented only in the form of an internal report to that organization, so that the literature is sparse. And even the best intentioned evaluator, if there is no publicly available common fund of wisdom to draw on, is necessarily limited by his own background and experience and potentially tainted by his own prejudices.

Furthermore, building such a fund of common wisdom would make it, almost as a side effect, easier to share the results of evaluations. Even if one did not agree with the way the evaluation had been done, or disagreed with the conclusions reached, there would be shared grounds for arguing about it, or for rejecting some parts and accepting others. This would help to avoid considerable waste; how many separate organizations have independently evaluated any single one of the well-known machine translation systems?

One possible obstacle to sharing results might be reluctance on the part of the manufacturers and vendors of particular systems to let the results of the evaluation be known; but there does seem to be a growing awareness amongst the manufacturers, manifested by a willingness to participate in discussion of what constitutes a valid evaluation, that ultimately it is to their advantage to have well-established and commonly accepted evaluation methodologies.

The organization of an Evaluators' Forum in 1991 (see Falkedal[5]) and of a workshop on evaluation in 1992 (organized by AMTA with the support of IAMT) is a concrete acknowledgment of the importance of sharing experience and working towards a common understanding. A further workshop in

1992 was organized by EAMT in conjunction with the Saarbrücken Technology Fair.

A further motivation for collaboration begins to emerge when the cost of a serious evalution is taken into account. Even what has been said so far implies a considerable investment, and we have not so far looked at all at what kind of resources might be needed to carry out a valid evaluation and how much they might cost. Let us turn to that question now.

Resources for evaluation

As can be deduced from previous discussion, evaluation is becoming more and more of an expert task. Apart from the cost of this expertise in itself, the cost of an evaluation depends also on the resources required to collect the pertinent data. In previous work, four types of resources have been used or proposed.

One classic technique is to use rating scales, for example by asking a group of people to rate translations for their intelligibility or for their faithfulness to an original. Some problems have already been mentioned with the use of such techniques, but if we set aside any reservations about their use, it remains true that rating scales cost money to set up. This cost is increased when good experimental design aimed at removing or at least mitigating some of the problems is also required.

A second classic technique is to submit a text or a collection of texts to the system to be evaluated and to examine the results. Such a corpus may be specific to a particular context, for example when a potential customer is primarily interested in a system's ability to translate his own technical documentation, or may be more general. In either case, if the corpus has to be constructed, it will cost time and money to do so. Even if the texts are available in machine readable form, they will typically have to be prepared for input to the system, for example by removing formatting commands or photo-composition codes. Especially in the case of general corpora, there are also problems of representativity which may call for the investment of additional expertize. For example, one of the well-known corpora publicly available is the proceedings of the Canadian Parliament, especially valuable because parallel English and French versions exist. This corpus is clearly representative of the language used by Canadian members of Parliament, but not, say, of the language of written minutes or of technical documentation. Several recent initiatives, such as the European Corpus Initiative, the Linguistic Data Consortium and the Data Collection Initiative of the ACL aim at collecting a wide range of corpora and making them available to the community as a whole.

Recently, quite a lot of interest has been shown in the use of test suites as a tool for evaluation. A test suite is a carefully constructed set of inputs, where typically each input is designed to probe the system's behaviour with respect to some specific phenomenon. For example, if we were interested in knowing whether a system could deal with verbs like 'give' which allow the pattern 'Give x y', we might have an input 'John gives Mary a book', where possible interference from other linguistic phenomena is minimised by keeping the noun groups very simple. Such test suites are both difficult and costly to construct, and become more so if semantic or translational phenomena are to be taken into account. (See King and Falkedal[6] for a discussion of some of the problems). On the surface, at least, they therefore constitute a prime candidate for a resource to be developed collaboratively and subsequently shared. A current project (TSNLP) in the context of the EEC's Linguistic Research and Engineering programme is aimed at investigating the feasibility of this.

In the context of fact extraction, considerable effort has gone into developing test collections for use within the ARPA funded projects represented in the MUC conferences. (See, for example, Lehnart and Sundheim[7]). A test collection is a collection of inputs where each input is associated with a correct output, usually accompanied by guidelines justifying the definition of the correct output. As might be imagined, test collections are even more costly to develop than are test suites. Except in very specific cases it is hard to imagine how a test collection could be developed for use in evaluating a machine translation system, simply because of the difficulty of defining a 'correct' translation, but they deserve mention here if only because their development in the ARPA context has contributed much to the growing awareness of the importance and difficulty of evaluation.

The work of the CEE EAGLES Group on evaluation and assessment.

Considerations such as those discussed in the last two sections are at the basis of a recent initiative of the Commission of the European Communities. With the aim of working towards re-usable resources, the Expert Advisory Groups on Language Engineering Standards started work early in 1993. There are five groups in all, on Lexica, Corpora, Linguistic Formalisms, Speech and Spoken Language and Evaluation and Assessment.

In a desire to reach concrete results as soon as possible, the Evaluation and Assessment Group has decided to limit its work during the first two year period of activity to developing evaluation methodologies for market or near-market products in application areas where the underlying technology is relatively stable. Thus work will concentrate on methodologies for evaluation of writing aids and translators' aids, and a preliminary investigation of what might be required from information management systems.

In an attempt to produce results which will be useful to a large number of people, the paradigm adopted is rather like that of the reports to be found in consumer organization magazines like *Which?*.

Different dimensions potentially relevant to adequacy evaluation of the products in question are determined and criteria, measures and methods given for evaluation along those dimensions. The user of the evaluation can then determine for himself which dimensions are relevant to his particular case and tailor the evaluation to suit his needs.

Despite the comparative modesty of these ambitions, the work is intended to contribute to the definition and validation of a general framework for the design of evaluations, which, it is hoped, will contribute to resolving some of the problems set out in this paper. The results of the work will, of course, be disseminated as widely as possible.

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Marketing information systems

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Abstract
This article has examined the changing role of MKIS. The types of questions to which MKIS need to respond have been identified, and the range of types of MKIS systems are introduced. It is proposed that the marketing mix is extended to include 5 'P's, the conventional four: product, price, place and promotion, plus data Processing. MKIS face a number of challenges over the next few years in response to changes in the marketing and information systems environment. In particular, they will need to develop to handle ever more complex market analysis and to accommodate the challenges posed by new methods of marketing and selling such as teleshopping and direct marketing.

The growing importance of marketing information systems

Marketing is concerned with customers and the satisfaction of their needs with appropriate products and services. Marketing information systems are being established and maintained by many organizations to assist marketeers in decision making (e.g. Piercy and Evans (1983), Buzzell (1985) and McKenna (1988). More specifically, over the past twenty years, the PIMS (Profit Impact of Market Strategy) programme has developed a set of principles and a methodology for business strategy founded on a database of nearly 500 companies and over 3000 business units (Buzzell and Gale (1987)). Figure 1 summarizes the developing applications of customer databases since the 1960s. The marketing purpose of customer databases has shifted from a contact list which can form the basis for communication with customers, to an important tool in the relationship between customer in the generation of repeat business. Equally the method of use of the database has shifted in focus towards a more direct communication with customers. The database has become more central to the relationship with the customer and organizations have sought to cultivate these relationships more strongly in an ever more competitive marketplace.

Market analysis and MKIS

Marketing information systems (MKIS) must be designed to support the types of decision making in which marketeers need to engage. These decisions derive from the basic questions that marketeers need to ask. It is therefore appropriate to consider these questions when beginning to consider marketing information systems although there is some variations from one business sector to another. The list proposed by Beaumont is relevant in a wide range of environments. This is given in Figure 2. Essentially marketing analysis focuses on the definition of markets, the description and location of target groups and a consideration of the purchasing process. It would be time consuming to consider each of the questions in Figure 2 in turn, but clearly data are required to support decision making in relation to each of these questions. To take one example, the question 'Where are our customers?' This question requires data to be collected on two levels. Data

Figure 1. The development of the use of customer databases in marketing

	1960s	1970s	1980s	1990s
MARKETING PURPOSE	Separate channel of distribution	Cost-effective measurable communicating	Cross-selling Maximum value of existing base	Maintain and increase customer loyalty
METHOD	Mail order	Direct mail	Direct mail to customers	Integrated communicating mail, telephone (in) sales staff
IMPACT OF DATABASE	Database essential basis for business	Database optional 'Junk Mail'	Rationalize development for targeting and control	Database essential to manage customer relationships

Figure 2. Fundamental marketing questions (Beaumont 1991)

WHO?
are our customers?
should our customers be?
are our competitors?

WHAT?
new/existing products and services should we develop?
new/existing markets should we enter?

WHERE?
should we develop?
are our customers?
should we distribute our products and services?
are our competitors?

WHEN?
should we launch new products and services?
should we enter new/leave existing markets?

HOW?
should we promote our products and services?
should we distribute our products and services?
should we handle consumer reactions/expectations?
should we compete?
should we maximize our returns?
should we maintain our performance and evaluate new opportunities?

WHY?
should consumers buy our products and services?
should we develop new products and services?
should we remain in particular markets/businesses?

collected from existing customers which include characteristics such as age, family groupings, distance travelled to the store and buying behaviour, will yield a profile of existing customers. Potential customers can be located by using this profile and matching it against external demographic data in order to identify the location of other members of the public with a similar profile to existing customers. The organization needs to take both an external and internal view and to collect data which derive both from within and outside the organization. The organization needs to collect internal data from a variety of different sources to provide a sound existing customer and purchasing profile. Such sources as in-store interviews may yield a profile of various characteristics such as the socio-economic group, age, and family group distributions of existing customers. Only externally generated demographic information, such as census data and data collected by market research organizations will yield a profile of potential customers and allow comparisons to be made between actual customers and the base populations of the area.

Types of marketing information systems

Marketing information systems (MKIS), like all other types of information systems, can be broadly categorized into four kinds: transaction and operational data processing systems, management information systems, decision support systems and executive information systems:

1. Transaction and operational data processing systems maintain records concerning the basic operations of the business. Examples include sales transactions and inventory systems.
2. Management information systems often make use of the data in transaction processing systems, but offer basic summaries and analyses of that data. Typical outputs from MKIS are structured, scheduled, and/or exception reports which should inform management and support decision making. For example, in retailing, regular weekly and monthly reports on branch sales by product line are provided with associated exceptions reports highlighting important conditions such as below average branch sales.
3. Decision support systems assist managers with unique, non-recurring strategic decisions, that are relatively unstructured. DSS use a database management system to store data, and a model building and data analysis facility to allow the building of models to describe the interrelationships between the important variables in a particular environment. A good example of a DSS that might be used in marketing is a geographical information system. One widespread application of GIS is in retail locational planning.
4. Executive information systems are designed to assist top level executives with the acquisition and use of the information that is necessary for strategic management. The emphasis is on presentations and ease of use in highly unstructured decision situations which need to draw on information from a wide range of sources. For example, a manager may wish to compare last year's sales figures with those of a competitor. In order to achieve this, the manager accesses reports on publicly held companies which are available from external financial databases and then accesses the yearly sales figures for the manager's own organization. The EIS will compare, in graphical form, the competitor's sales with the organization's sales.

These four categories of system support operational, tactical and strategic management decision making. For example, detailed, and sometimes real-time data are required on stock levels for inventory control, so that efficient replenishment is achieved via the warehousing/distribution system. For strategic planning, on the other hand, much less detailed information from a broader range of sources is required in order to assess alternative distribution channels and branch and warehouse locations.

The five 'P's of the marketing mix

Conventionally the marketing mix is summarized as the 'four Ps' : product, price, place and promotion. (see Kotler (1988)). Marketeers must manage this mix effectively, and Beaumont proposed that increasingly, a fifth P-data processing should also be acknowledged as being significant. Figure 3 summarizes the relationship between the other 4 Ps and Data Processing which is shown as central and integrated. However the marketing mix will continue to differ for different markets.

As organizations have become more strategically focused and have needed to consider the marketplace more analytically, disciplines which were once distinct, such as marketing analysis, marketing and business planning are moving closer together. All such activities need good information about the market, such as can be provided by an effective marketing information system.

Figure 3. The five 'Ps' of the marketing mix

Product
Brand
Characteristics
Options
Packaging
Quality
Service
Style
Warranty

Price
Credit
Discount
Payment methods
Retail price

Processing
Data collection
Data analysis
Data presentation

Place
Coverage
Distribution channels
Inventory
Locations
Transport

Promotion
Advertising
Merchandising
Personal selling
Public relations

New challenges for marketing information systems

The need for effective marketing information systems is likely to become more crucial. In order to remain effective MKIS are likely to have to respond to the following challenges in the next few years:

1. Changes in the marketing environment which have led to a more aggressive environment in which it is more necessary to be fully informed about the marketplace.
2. Further integration of information systems to allow integration of different datasets. For example, retailers need to integrate datasets in areas such as merchandising, store planning and market research with external datasets.
3. A changing information systems environment which features wider networking, more user friendly systems, and greater awareness of the strategic impact of effective information systems.
4. More extensive data sets are likely to become available from sources such as electronic point of sales (EPOS) systems and electronic funds transfer at the point of sales (EFTPOS) systems which can provide detailed data concerning customers' purchasing patterns. MKIS will need extended analytical capabilities to cater for such data.
5. New methods of marketing and selling. Electronic Data Interchange which supports electronic invoicing has already revolutionised sales transactions between businesses. Teleshopping and various means of direct marketing are likely to have two separate effects. They may draw customers from existing markets. They are information-based and it will be relatively easy for retailers to develop a more accurate picture of their customer profiles.

Conclusions

This article has examined the changing role of MKIS. The types of questions to which MKIS need to respond have been identified, and the range of types of MKIS systems are introduced. It is proposed that the marketing mix is extended to include 5 'P's, the conventional four: product, price, place and promotion, plus data processing. MKIS face a number of challenges over the next few years in response to changes in the marketing and information systems environment. In particular, they will need to develop to handle ever more complex market analysis and to accommodate the challenges posed by new methods of marketing and selling such as teleshopping and direct marketing.

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Terminology and the computer – attention shifts to the micro

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Abstract

Following an outline of the organizational context of terminology work in the Commission, this paper considers the various types of computer application used, ranging from mainframe terminology databases (Eurodicautom) through documentary databases and wordprocessing software to specialized PC applications, with particular attention to current developments. An attempt is made to explain the factors leading to the development of an in-house terminology management tool for a networked PC environment and the features of the package developed are reviewed. Consideration is also given to the lessons which others might draw from the Commission's experience.

Introductory Health Warning

Several words of warning should be given at the outset. Firstly, this paper is not intended as a balanced presentation of terminology and the computer in the Commission of the European Communities. Rather, attention is centred on the author's own special area of interest, namely **terminology and the microcomputer**, which it is to be hoped will also correspond to the interests of conference participants. Secondly, those hoping for an academic discourse on the topic will hope in vain. It is sixteen years since the author could, by any stretch of the imagination, have been described as an academic, and the topic is at all events one which should benefit from a pragmatic approach. Finally, and perhaps almost in contradiction to the last point, no attempt will be made to recommend, or criticize, specific products available on the market. Aside from the need to maintain the position of impartiality incumbent on a public servant, it would quite simply be unwise to make qualitative assertions in the context of a rapidly evolving market in which yesterday's leading contender may well be today's lamebrain and vice versa. What will, however, be attempted is a general guide to potential gains and pitfalls.

THE REAL THING

Organizational Context

All that follows must be seen against the background of a translation operation with a unique combination of characteristics. The Commission's Translation Service is the largest such service in the world, with over a thousand staff. It is also unusual in its need to cover nine languages as both source and target, with a substantial proportion of the texts translated acquiring direct legal force in the Member States.

The impression of a monolithic organization which this might suggest is, however, misleading, since the Service is broken down for operational purposes into seven subject-based departments, (each serving a number of Commission Directorates-General), each of these in turn subdivided into nine units of around twenty staff (translators plus support staff). The correlation of nine units and nine official languages is, of course, not coincidental. Each unit is linguistically homogeneous and has responsibility in principle for translating all texts in its subject area into the mother tongue of its translators. Thus, there is a Danish translation unit for external relations, customs and development, and an English translation unit for agriculture, fisheries and the structural funds – and so forth.

A further significant division exists in geographical terms, with part of the Service located in Luxembourg – for a combination of political and operational reasons. As an aside, be it said that this geographical separation has its impact on questions of integration of computer systems.

Finally, in addition to its seven translation departments, the Translation Service has a number of 'horizontal' or staff units, most of them grouped together in a Directorate for General and Language Matters. The author's own unit – Terminology – falls into this category, being additionally split more or less evenly between Brussels and Luxembourg (36 staff in Brussels and 39 in Luxembourg).

Terminology – Pragmatically Speaking

This first mention of 'terminology' – after the title – brings us belatedly to the question of what we actually mean by the word. Since this topic could, of itself, easily occupy several papers of high soporific potential, the definition adopted here will be purely pragmatic (and – please! – not open to discussion). Terminology will be taken as the identification of equivalents in other languages for problematic words or phrases (in all fields – not just the conventionally 'technical') and the utilization of such equivalences as aids to the work of translators and others. Note that this includes, but is by no means confined to, normative terminology (the production of terminology 'standards'), which in any case only represents a relatively small proportion of the work of the Commission's Terminology Unit.

Eurodicautom – The Mainframe in its Element
In a translation operation of the scale indicated above, it is not surprising that the best known and most important dimension of terminology and computers should be the Commission's mainframe terminology databank Eurodicautom, which will already be familiar to many conference participants. In spite of its software having for the most part been devised as far back as the seventies, this system continues to demonstrate some of the strengths of the mainframe at its best. In particular, the speed of response (at least when using the Commission's own interrogation software) is impressive bearing in mind the volume of information (this remains the largest terminology databank in the world) and the fact that the computer holding the information is located physically in Luxembourg. A further plus point is the relative simplicity of the user interface, which is sufficiently unintimidating for even the computer illiterate. These two points of response time and interface are crucial to the implementation of almost any system which is to be used by more than one person and will come up again in our consideration of microcomputer applications.

At this point it is worth emphasizing the great variety of the texts to be translated by the Commission. It used to be said that we could be expected to encounter all fields of human endeavour except defence – now even this exclusion can no longer be taken for granted. This situation contrasts with that of many other relatively large-scale translation operations (e.g. those in multinational companies, which often concentrate heavily on technical manuals and technical marketing material for a limited range of products) and means that for the foreseeable future a high-performance, broad-coverage tool for on-line terminology queries is going to remain vital. Also significant in this context is the availability of Eurodicautom on-line to users outside the Commission, including translators working for the Commission on a freelance basis.

Eurodicautom is certainly not ideal as it stands. Weaknesses exist as regards user interface and interrogation capabilities, speed and flexibility of updating, batch processing capabilities and quality of content in certain areas.

User interface and interrogation capabilities. In spite of Eurodicautom's already considerable ease of use, some improvements have been requested, notably the possibility of establishing user profiles which will avoid the need to specify such parameters as source and target languages at system startup. Similarly, some fields which cannot currently be interrogated under normal circumstances should be made available to searches.

Speed and flexibility of updating. As matters stand, updates do not always occur as fast as users would wish, although progress has been made in the last year or two. There has also been criticism of the lack of scope for on-line updating of information by ordinary users. This, however, is more an indication of one of the areas where a central system does not provide the whole answer than a criticism to be answered within such a system. Consider the implications of allowing all (or many) of the thousands of users of such a system to modify entries directly – a recipe for confusion, and certainly **not** a path to improving the consistency of the quality of entries (already a sensitive point). The answer would rather seem to lie in the addition of a further, local layer to the system – of which more anon.

Batch processing capabilities. Limited facilities for batch processing (i.e. the processing off line of a series of queries submitted to the computer together, as distinct from conventional interactive query processing) already exist, but this is certainly an area where more needs to be done to integrate Eurodicautom with current efforts to promote labour saving in the translation process.

Quality of content. There has been some dissatisfaction as regards the quality, and particularly the consistency of the contents of Eurodicautom. This can partly be explained by the system's underlying philosophy, which has from the outset been to provide a maximum of information, leaving ultimate responsibility for judging the information to the user. Clearly, such an approach has disadvantages for the non-translator user in particular. It does, however, have the advantage of having enabled the databank to grow sufficiently rapidly to reach "critical mass" before users lost patience with the system. This refers to the generally accepted principle that a mass-user system will only gain a degree of popularity amongst ordinary users if it provides viable answers to a significant proportion of questions. This is clearly a problem in the early days of a system, when insistence on very strict quality-control can damage long-term credibility by slowing down the pace of data entry to a crawl. The other option - to leave the system off line until it reaches critical mass - is also unlikely to be an answer, since the impatience of both senior management and the prospective users, aware that an information tool has been under development for some time, will prevent this situation being maintained for any significant time. It is consequently not surprising that Eurodicautom, like other large-scale translator-oriented terminology databanks, initially gave priority to volume of data input.

Now, however, the early days are past and quality control must occupy a greater place in the scheme of things. This is, indeed, the policy now being followed as regards both new entries and existing material, at least for the public version of Eurodicautom (though some material of a more questionable quality may continue to be added for in-house use only). The methodology of efforts to improve quality is a question of considerable delicacy, influenced also by cost factors and considerations of copyright attaching to certain collections in the databank, and falls outside the scope of this paper.

At all events, there is no reason why Eurodicautom, in either the more refined version of its present incarnation currently under development or possibly a radically restructured 'reincarnation' incorporating other resources and meeting rather wider goals, should not continue to provide the central, high-performance base required to answer the majority of Commission translators' terminology queries.

Who Needs Anything Else?

The idea that a central terminology databank can be **all things to all men** is ridiculous, however. Even at the mainframe level, terminologists both require access to other resources and may assist in the feeding of other systems.

As far as feeding other systems is concerned, mention should be made of machine translation systems (specifically, the Systran system which has been operational, for limited purposes, within the Commission for some years). There is scope for input to system dictionaries from the Terminology Unit. This possibility has, however, only just begun to be fully exploited, partly due to the operational context in which machine translation has developed and partly because of constraints which in the past prevented the transfer of information 'en masse' (e.g. the need to specify parts of speech or the like so that grammar rules can operate correctly). Similar possibilities for data input by terminologists (not subject to the same constraints) exist in relation to machine-aided translation systems (currently taking the form of text preprocessors).

As far as other resources used by terminologists are concerned, the most obvious are full-text documentary databases such as those maintained by the Commission, which provide a means of rapid access to a vast body of textual sources (most of them already available in multilingual form). Terminologists also find access to a variety of other databases helpful in their problem-solving work. These can range from terminology databases produced by other organizations, such as the Canadian base Termium, through scientific abstract bases and technical standards bases to magazine and newspaper databases. This is the first point at which the microcomputer truly comes into the picture, since some of these bases are simply not available on line and can only be consulted in CD-ROM form, thus effectively necessitating the use of a microcomputer (and, indeed, an IBM PC-compatible for access to the maximum range of material). At the 'sharp end', terminology work will always have an open-ended, potentially insatiable requirement for such information sources. Thus far, however, there is little to distinguish the terminologist's requirements from those of almost any information officer – albeit the linguistic orientation of his searches often require databases to be used in ways for which they were never intended and are ill-suited.

Local Terminology Manipulation

Now we come to the meat of this story, namely the need for computer systems to cope with terminology management tasks not well suited to the powerful but rigid mainframe environment.

As has already been indicated, mainframe systems allow only limited scope for on-line updating. This, and the undesirability of exposing 'unripe' material to the public gaze too early in its life, are already powerful arguments in favour of some kind of local tool to manipulate terminology collections prior to uploading to the central databank. Additionally, the continued (and considerable) demand for paper products on the part of many customers (yet another disproof of the notion that computers were going to lead overnight – or even within the foreseeable future – to the paperless office) demands desktop publishing capabilities not readily available in a mainframe environment.

Minicomputers – Neither Fish nor Fowl

Attempts to meet the need for local tools within the context of the Unix-based minicomputer network which has until very recently been the Translation Service's primary working environment suffer from some of the shortcomings of the mainframe whilst lacking its strengths. Thus, aside from the data manipulation weaknesses inherent in wordprocessing systems (considered below), the sophistication of the wordprocessing packages available within the minicomputer environment proved unequal to the demands of serious desktop publishing and dependence on central system administrators constituted a severe handicap in the development of solutions specific to the Terminology Unit (whose needs almost inevitably took a back seat to those shared by 90% of the Translation Service and therefore perceived as offering more scope for productivity gains).

More potential at one time appeared to be offered by a minicomputer database system (developed using Oracle, for the technically minded) designed to provide a tool for terminology management to the individual translator and translation unit. Unfortunately, this failed to meet (and could not readily be adapted to meet) several of the Terminology Unit's cardinal requirements. Specifically, it was unable to cope with Greek at the same time as providing access to the full range of accented characters in the other Community languages and offered little in the way of assistance towards our desktop publishing goals. Furthermore, the system was initially cumbersome for data entry and searches were slow. Improvements have since been made in these last two respects, though the new search routines achieve speed at the penalty of a lack of sophistication.

Salvation in the PC

In these circumstances, the Terminology Unit in Brussels stumbled along as best it could for some time using the tools at its disposal (primarily the Unix wordprocessing system and a certain number of old dedicated wordprocessors – which were in fact more effective for the production of paper glossaries). The advent of a limited number of IBM PC-compatible microcomputers (and the prospect of a PC network in due course) together with the arrival in the Unit of a computer freak with some programming knowledge (guess who) combined to direct attention to the scope for achieving rather more, given the potential flexibility of PC applications and the possibility of at least to some extent controlling development from within the Unit. With hindsight it is clear that the outcome could equally well have been a total flop, and the lesson to be drawn from this paper is certainly **not** that in-house development is the panacea for all ills!

No Commercial Package Ideal

Over the past couple of years, consideration has been given to the possibility of using a variety of commercially available software packages to meet the Unit's specific needs. So far, no package or combination of packages has seemed to meet the bill. To see why, and also to highlight for others in a similar situation the importance of considering **all** requirements from the outset, a brief summary (not necessarily in order of importance) of our key needs is called for:

Full multilingual capabilities. As mentioned earlier, any system chosen would have to be able to display Greek correctly at the same time as all other Community languages. It should also permit easy data entry in all Community languages. More than this, it should sort correctly in each language (including the difficult cases such as Danish, the Spanish ll and ñ, and Latin characters occurring in Greek texts), preferably also allowing for 'filler' words such as 'de' and 'à' in French to be ignored, as many linguists would expect in a dictionary.

Full multiuser functions. Even if initially implemented on a standalone basis, the system should be fully network ready. In other words, it should allow files to be opened and modified simultaneously by several users, with full file and record locking facilities to ensure data integrity. The primary reason for this requirement is to rationalize and speed up the entry of multilingual terminology lists produced under pressure of time – a frequent requirement. Very significant gains are possible here if several terminologists and/or secretaries can work on the file at the same time, entering or correcting information in different languages from different machines.

Sophisticated and fast search functions. Information currently being worked on must nevertheless be available at least to local searches, preferably on both a single file basis and across multiple files. Such searches should be structured so as to work rapidly even in a networked environment, since the average terminologist is not much more patient than the average translator.

Direct export to the central databank without manual reformatting. Since the central databank is the ultimate destination of most material worked on in the Unit, logic demands that information be exportable with an absolute minimum of effort.

Easy import of information from other data formats. Given the amount of information that the Terminology Unit receives from outside sources, any system adopted should be as open as possible to data in commonly encountered formats.

Extensive desktop publishing capabilities. In view of the demand for printed glossaries and terminology lists, desktop publishing capabilities (achieved either on a standalone basis or by close integration with a mainstream wordprocessing or DTP package) are a must. Perhaps most difficult of all, this should include at least partial automation of the production of cross-referenced indexes, which are both vital to effective use of a multilingual glossary and one of the most tiresome and time-consuming components to produce by hand.

Wordprocessing Packages Out of the Running

Looking at the above shopping list it is clear that even the most powerful wordprocessing packages fall short by a wide margin. Aside from other considerations, few of them have sorting routines which handle all Community languages correctly, even at the most basic level of absolute alphabetical order. They also have to be ruled out for any system which is to run in a multiuser environment, since even the mailmerge facilities of the most advanced wordprocessors fail to provide the proper facilities for file sharing. Practically speaking, this should rule them out not only for the Commission's purposes but for any terminology use other than **possibly** an individual translator keeping a very simple wordlist for personal use.

General 'out-of-the-box' database packages also fail

General database packages which are supposed to be usable straight out of the box (in other words without added programming by the user) also fail on several of the above counts. The multilingual requirement in particular is a problem, with some packages unable even to display Greek, whilst others have sorting routines which are inadequate and cannot be adjusted. Search routines are another area of difficulty. Whilst many packages at first sight have the necessary capabilities, their **fast** search routines are often unsatisfactory because they work on the basis of indexes and will only locate an element at the **beginning** of an entry. More flexible search strategies are usually also available, but operate unacceptably slowly on anything but a minimal volume of data (a problem exacerbated in a network environment). Indeed, speed of operation tends to be a general problem with PC database packages.

Those database packages which offer a sophisticated programming language have more potential. Here again, however, caution is required on several counts – one of speed. A distinction should be made in this connection between the majority – 'interpreted' database languages, which are slow because each instruction has to be translated into machine language every single time it is executed – and the minority of 'compiled' languages which are faster by several orders of magnitude because the instructions are compiled **once** into machine language and the whole program can then be executed directly, without the intervention of an 'interpreter'. Technically speaking, this is an oversimplification since even 'compiled' programs contain some interpreter-like features. Nevertheless, the basic point remains true.

A further, and perhaps more crucial problem, lies in the extent of the programming effort required to meet a sophisticated set of requirements. When this is to involve such enterprises as customizing sorting routines and automating the creation of cross-referenced indexes, the task should certainly not be undertaken lightly, or without substantial prior experience. Nevertheless, compiled database languages do have potential under certain circumstances and we will return to them later on.

Full-text Search Tools – Impressive But ...

A number of software packages have appeared in recent years whose purpose is to locate text rapidly anywhere in a large body of files. Clearly, such tools can be of benefit to the translator, e.g. in permitting searches of prior translations for problem phrases, and they mostly meet the requirement for sophisticated and rapid search routines. Unfortunately, they fail the requirements for a terminology-oriented application on almost all other counts.

Specialized Terminology Packages and Translation Workbenches

Specialized PC software packages aimed specifically at the translation market are now available. Some of them are designed as terminology management tools only, whilst others combine machine-translation capabilities with some terminology features and yet others claim to provide a complete toolkit ('workbench') for the translator including machine-aided translation on the basis of existing terminology collections or bodies of parallel texts.

It might be thought that one or more of these would provide the answer to all our prayers, but alas no. This is not to say that they would not provide the ideal solution for individual translators, or for organizations with requirements different to ours. The following comments should therefore be taken merely as illustrating a series of potential problems. In any case, no one product suffers from all the weaknesses cited.

Multilingual capabilities. Surprising as it may seem, many even of the specialist products are unable to meet our Greek 'litmus test'. Though our situation is perhaps more demanding than that of other organizations and individuals, it is clear that a key question for any potential buyer should be: 'Does the system cope properly with all the languages I am likely to need?' Beware in particular of statements such as: 'That language is not yet supported but soon will be' – believe it when you see it. For that matter, even seeing should not always mean believing – sometimes a particular language may be displayed correctly but not sorted correctly or (and this can be a problem in the Windows environment) you may not be able to use certain characters in a search because their display has in fact been achieved by screen font trickery without proper underlying coding.

Flexibility. Some products were originally designed for very specific needs and suffer from rigidities partially consequent on their origin. This may mean that certain key functions are absent and cannot be added. (In our case, no system came, as supplied, with routines to automate the creation of cross-referenced indexes.) Beware of giving up too easily on your most fondly cherished hopes (though some of them **may** ultimately prove unrealistic).

At least as annoying, and in some ways more so, is a rigid file structure. Many systems work with fixed-length fields and records – for what were, at least originally, sound software design reasons. At its extreme, this may mean that the user has no choice whatsoever in relation to record structure, and is obliged to work with exactly the fields (and amount of space) provided by the system designer. A particularly irritating variant of this occurs where the designer has also, in his infinite wisdom, decided that a whole series of fields **must** be completed before the system will accept a record **and** there is little or no scope for the automatic entry of default values. This is in direct contravention of the principle that computers should **save** labour and a sure way to demotivate all but the most dedicated users.

Less irksome, but still more of a problem than might be imagined, are the limitations on maximum field length (often around the level of either 100 or 250 characters) and/or maximum record length. At first, 250 characters may seem like a lot, but we, at least, have found many instances where it simply does not suffice. If the user is lucky, systems with this type of file structure may allow one (or possibly more) variable-length ('memo' or 'note') fields but usually subject to severe constraints (e.g. exclusion from searches) and possibly hidden disadvantages (see below – 'File bloat').

Even in their most innocuous form (leaving the user more or less total freedom to specify field size), systems with fixed field lengths require very careful design. The length of each field normally has to be specified at the time of file creation and cannot be changed with safety thereafter. Despite the best laid plans, it seems almost inevitable that Murphy's law should operate here, with the discovery at a critical stage that one field is too short for the information you want to enter!

File bloat (disk guzzlers). Another feature often ignored until too late is 'file bloat'. This is particularly characteristic of fixed-field length systems (which typically have large amounts of 'white', aka wasted, space since every entry must be as long as the longest you are going to require). It may be imagined that ever greater hard disk capacities make this a matter of little concern. Unfortunately, the space demands of software (particularly Windows software) have also grown, and space-intensive text databases such as the typical terminology database can consume the remaining megabytes in no time. A simple calculation, multiplying the length of all the fields required by the number of terms you expect to enter during the life of your existing hardware configuration (not forgetting to add the overhead normally required by the control information for each record), can be a chastening exercise.

Even systems with variable-length fields are not immune from the phenomenon of file bloat. At their worst (exemplified by one very common file format), they can actually be more wasteful than fixed-length fields. Even when the worst excesses of bad design have been avoided, it is unwise to assume that space requirements will be anything like as little as the number of characters the user actually types into the system. Significant additional amounts of space are almost always consumed by control information necessary to rapid movement through the file and reliable data retrieval, though the performance gains from this are usually enough to compensate for the disk space lost.

Network performance. Aside from the straightforward problem of disk guzzling, file bloat can also contribute to poor performance in a networked environment. At least in the case of systems where the software is run on each individual PC, fetching data for a multiuser system, as mentioned earlier). Many of the systems currently on the market have developed from an essentially single-user background and still reveal evidence of this in fragile network implementations. Of course, for the self-employed translator, or even very small workgroups, this handicap may be of limited significance.

Absolute speed/power/simplicity mix. There is often a tradeoff between absolute speed, power and ease of use. Speed may be achieved at the expense of flexibility and power (in the sense of the range of tasks which a system can perform), since it is easier to program a system to perform a relatively rigid and limited range of tasks at high speed than it is to devise a package which will be both open-ended and fast. A compromise solution chosen by at least one package (following the pattern of many mainstream software packages) is to provide an extensive scripting or macro language which the end user or intermediate developer is supposed to use to customize the system. Unfortunately, such languages generally suffer from the speed shortcomings of 'interpreted' computer languages outlined earlier. At the same time, they are non-standard and thus require even those with previous experience to relearn how to program (with a language which can only be used in this one context). They will also tend to lack some at least of the elements of full-blown programming languages, making certain customization tasks either impossible or, at the least, fiendishly difficult. Once again, the automation of cross-referenced index production proved a case in point, giving the author a severe case of intellectual indigestion.

User friendliness. Ease of use is also impeded by the need to use scripting languages to implement more than the most basic of functions. Of course, the reverse may be true if an enthusiast can be found to undertake all the script language programming or this work can be contracted out (though the narrowness of the market means that the package's authors will probably enjoy a near monopoly of such contracting services).

Lack of user friendliness is a problem in other respects too. Many packages require a considerable effort at the outset in terms of designing file structure and/or expect the end user to master a relatively complex set of manipulations even for basic data

Desktop publishing capabilities. Though this may be of lesser significance to some user groups, lexicographers and terminologists require advanced desktop publishing capabilities. In addition to data manipulation questions such as the already cited problems of sorting and index production, this also implies sophisticated text formatting functions, since the users of 'paper' terminology products increasingly expect output of near-book quality even in limited-distribution documents. Specialized products can rarely offer all the facilities necessary on an internal basis.

Integration with other software. A potentially powerful solution is to opt for integration with a mainstream software package, perhaps by producing files in a format compatible with that package, ready for final tidying up (if necessary) and printing. Some terminology management packages at least claim to implement such a solution. Unfortunately, a measure of caution needs to be exercised here because integration is usually with one of the simpler file formats – perhaps Ventura Publisher (which uses 'logical markers' rather than special codes for formatting and text attribute information) or Microsoft RTF (Rich Text Format) – a file format designed in principle to permit the exchange of information between a number of packages with minimal loss of formatting and attributes. This may be all the user needs in certain circumstances, but inadequacies are likely to show up when attempts are made to operate in a translation workbench mode, using terminological information as an aid in text processing.

Conversion and reconversion – a recipe for frustration and wasted effort. Ideally, a translation workbench should operate directly on files in the 'native' format of the user's customary word-processing system. Few systems actually do so – be it noted that neither Ventura Publisher format nor Microsoft RTF are truly native to any major wordprocessing package (though a point might be stretched in the case of RTF and Microsoft Word). To take a concrete example of the problems which can result, the Commission's Translation Service is in the process of converting to Wordperfect as its main wordprocessing package. Wordperfect can read Ventura Publisher files with no problem, but it cannot translate the formatting and attribute markers into the corresponding codes, so these markers will be printed as ordinary text! The apparent alternative of using Ventura Publisher itself for wordprocessing is simply not realistic, firstly because the rest of the Commission would not follow suit (thus guaranteeing that texts would have to be 'converted' at some stage) and secondly because using Ventura for ordinary wordprocessing would be rather like trying to type wearing woollen mittens. Similarly, though Wordperfect claims compatibility with RTF, the implementation is imperfect at least in the versions used by the author. Yet worse is the situation with a package which will only use 'ASCII' or 'generic wordprocessing' files. This effectively loses all formatting and attribute information and the resulting files will require extensive reworking before they can be delivered to any customer requiring other than the simplest of output. The initial instinct may well be to shrug and accept the additional work of file conversion (particularly if there seems to be no better alternative), but experience of working over a period of several years in a context of repeated file conversions has taught the author to mistrust any systematic requirement for conversions as a source of frustration for all but the most dedicated enthusiasts.

Operating environment constraints. The above problem is actually only one facet of a wider question of operating environment constraints. Such constraints exist for all users, but are perhaps most acute not for the self-employed translator working alone (who may have limited funds available but can at least decide what to spend the funds on with a reasonable degree of freedom) but rather for those operating in the context of a large organization. In the latter case, it is likely that any system acquired will have to fit in with an existing computer environment rather than vice versa. Typically, this will be a network of IBM PC-compatible machines running Windows 3.1 and DOS, with either Wordperfect or MS Word (DOS or Windows versions) as the main wordprocessing software. In this situation, opting for a system which requires OS2 (as is the case with at least one market contender) or one of the various PC flavours of Unix is a non-starter. Even a DOS package may be unacceptable if it will not run reliably under Windows or requires more base (as opposed to total) memory than is available in the network environment. The reverse side of this coin is that a system specifically designed for Windows should be looked at carefully to check that its speed has not suffered significantly because of the greater effort it needs to put into display management and other 'housekeeping' tasks. For all of the above reasons, beware of demonstrations using limited volumes of data in a computer environment different from the one in which a system will have to operate (even if you are assured that this should 'make no difference'). This is all the more true if the cost of the system is high. Here, too, comparisons need to be made with care, since costs can vary widely and the value-for-money calculation can look radically different depending on number of users and pricing structures – one system which is expensive for a single copy but requires only one licence for the whole organization may, for example, turn out much cheaper than another which has a lower cost per copy but requires the purchase of a licence for each user in the organization.

AND NOW FOR THE GOOD NEWS

From the tenor of this paper so far, the reader might be forgiven for thinking that he should go home and hide in a corner hoping that the computer age will go away, or that the boss will select some other poor fool to find the 'ideal system'. In reality, the intention is merely to introduce a degree of healthy scepticism before going on to outline, in the light of the Commission's own incomplete experience, some of the things the user can aspire to do with PC-based systems in the field of terminology work.

Genesis of a PC-based System

A good deal has already been said about the whys and wherefores of not choosing a commercial system. To look at the development of our in-house system in a rather more historical perspective, it originated (essentially in the author's mind) as a response to two prime needs. First came the need for a system to replace and improve on the functionality of the ageing dedicated wordprocessor system used for the production of glossaries when the author first joined the Terminology Unit some four years ago. Interestingly, however, the second impulse behind the system came from a requirement which partook of both terminology and computer-assisted translation, namely the need for a system to compile and manage the information required for the processing of a regularly recurring (monthly) list-type document to be translated into all Community languages, and actually produce (re-sorted in all the target languages) the actual translation.

These relatively modest beginnings defined a number of the essential features of the system, but others have been added at regular intervals. Even now, the pace of development has slowed only a little, and hardly a week goes by without functions being added to the package or significant changes being made in existing functions. This, indeed, is one of the major benefits of not just in-house but in-unit development – the ability to respond very rapidly to new demands (or the discovery of shortcomings!). Of course, there is a downside too – potentially dangerous dependence on a single programmer (the 'And what if he walks under a bus?' syndrome). Partly to allow for both of these considerations, the development tool chosen was Clipper, a popular database development language descended from DBase with a strong admixture of C and the latest trend – 'object orientation'. This combines the advantages of short development time (because it is a very high-level and modular language) with relatively good performance (since it is compiled not interpreted). Moreover, add-on modules in C or Assembly language can be acquired (at generally modest cost and from a vast range of third-party products spawned by the language's popularity as a development tool) and incorporated to perform speed-critical tasks. It is, in fact, only thanks to such modules that the system now has fast and flexible text search routines and an efficient, space-saving file format.

As it now stands, the local system – known within the Unit as TMan (supposedly as an acronym for 'Terminology Management System' but really for no better reason than the author's delusions of grandeur) – can be summarized as follows:

Prime function: To store and manage multilingual (in practice usually 9-language but theoretically unlimited) terminology lists in a networked PC environment whilst allowing easy transfer to the central databank. As already mentioned, Eurodicautom itself is not really suited to the preliminary stages of work on terminology collections, added to which some short-term terminology support projects (tied directly to a very specific text or group of texts) may only incidentally give rise to Eurodicautom input.

Operating environment: Currently, the Terminology Unit in Brussels operates with a mixture of UNIX terminals (with no local processing capability) and 12 PCs (486 33 MHz machines with 210 MB hard disks) linked up to a PCNFS network (not one of the most common systems but not particularly unusual in the features offered at local level) providing printer and archiving services, access to central Commission (and external) databases via UNIX servers and a shared DOS-format hard disk on one server to hold data for the local terminology management package. The prime working environment is Windows 3.1 (with MS DOS 5), using a standardized (and simplified) menu-driven interface. As mentioned earlier, the main applications software is Wordperfect for Windows (version 5.2). TMan is not a native Windows application, but rather a Windows-aware DOS application which can be run from the Translation Service's standard menuing system, if necessary remaining open alongside Wordperfect or other applications. In this context, it is important to note that TMan is equally happy running full-screen or in a reduced-size window. Display and entry of all Community languages is achieved by means of special DOS display drivers requiring at least an EGA screen adapter. As the display drivers will not work in a 'windowed' DOS session (though the keyboard driver does!), correct display of Greek in windows has been achieved by (in-house) adaptation of the fonts used by Windows 3.1 for windowed DOS display (a relatively simple task using readily available software tools).

Full multi-user and network performance features: One of the main impulses behind the development of TMan was the need for a system which would radically simplify the process of managing collections to which a number of people (terminologists/secretaries for different languages) need potentially simultaneous write access. Previously, the best that had been achieved was wordprocessor files archived in a UNIX network location accessible to all in the Unit, but this did not permit **parallel** updating by several users, and the wordprocessing option had a number of other serious weaknesses (notably the difficulty of restructuring file output and the inherent fragility of arrangements imitating a database using wordprocessor 'forms' (where the deletion of a single character can all too easily ruin record structure – and sometimes even a whole file). Even the standalone version of TMan was preferable to this in terms of file structure, but much time was wasted in exchanging copies of files and version tracking (to ensure that the most recent versions of all languages were to be found in the same copy of the file!).

The multi-user features of TMan are consequently fairly highly developed even though the PC network has only been operational for a relatively limited period. In fact, the system was more or less network-ready before the network was more than a gleam in the Computer Department's eyes, thanks at least in part to the fact that Clipper is specifically designed to work safely in such a context. In particular, both file-wide and single-record locks are catered for to arbitrate potentially simultaneous updating by multiple users (with most changes being committed to disk and becoming visible to other users immediately following modification of a **single field**). Optional password protection is available at both file and individual record level, though with provision for 'superuser' and system administrator overrides. Also contributing to data integrity are backup and archiving procedures and, arguably, a recent switch away from the traditional 'DBF' format as the primary storage vehicle (though it remains available as a secondary vehicle). The main reason for this switch was to make better use of disk space, since the new format is an efficient variable-length fields format, whereas the DBF format is a fixed-field length disk gobbler. Two secondary networking benefits come with this switch, however. Firstly, the resulting smaller files allow faster access since less data has to be moved over the network. Secondly, data integrity safeguards are no longer vulnerable to the intervention of an unauthorized user accessing the data with one of the many tools for viewing 'DBF' files to be found on the market (some of which can damage a Clipper file by writing to it just once even without changing data, since Clipper allows fields longer than is permissible in a 'standard' DBF).

Quick start: One of the problems of some of the simpler-to-use systems is that they impose a predefined file structure with little scope for user modification (and very possibly incorporating fields which the user may regard as unnecessary but will have to complete every time he makes an entry (or at the least leave in the file, wasting space and causing general irritation). At the other extreme, some of the more flexible systems show their 'enthusiast' background by forcing the new user to go through a complex process of file design before he can get started. On the one hand, the Terminology Unit requires files varying significantly in structure for different projects, whilst on the other most of its staff are **not** computer enthusiasts simply dying for the opportunity to engage in a bit of file design (and a limited range of file structures will in any case suffice for most purposes). TMan therefore offers three basic file creation options: a Eurodicautom-compatible file structure in which the user has only to specify the languages required; creation of a new file modeled on an existing file but with the opportunity to change characteristics; full custom file creation (for the brave). For the truly lazy user, a default Eurodicautom-structure file with fields for all official languages is provided.

Rapid, guided data entry: Users expect fast data entry with all the labour-saving devices to which they are accustomed in wordprocessing systems. In the case of TMan, this means: cut and paste – including direct cut and paste with Wordperfect (via internal procedures, not the Windows clipboard, which does not work well with DOS applications even at its best); keystroke macros, various forms of global replacement (field by field, file-wide, with or without confirmation, with or without 'wildcard' characters, etc.); default entries for certain fields; record date and time stamps; deletion and reinstatement of records with a single keypress; both full-screen ('Page') and table (spreadsheet-like) viewing modes; optional checking to prevent duplication of entries (either as they are being made or as a batch operation). On-screen help is also available, not only in the shape of context-sensitive help accessed by pressing the F1 key (as in most PC applications), but also in the shape of reminders remaining on screen during normal operation. The main data entry screen includes a summary of key functions, for instance. This latter type of assistance is specially appreciated, perhaps because the majority of TMan users rarely think to press the Help key, having switched from Unix applications in which on-line help was very limited.

Fast record location: Also important in our system are fast record location facilities. It is relatively simple to implement 'absolute movement commands' (such as movement to the first or last entry, or to a specific record number, or *x* entries forward or back – assuming a system in which records are basically ordered sequentially by date and time of entry). These, however, are primarily of use in data entry and modification – they do not answer the problems of searching for terms.

Even in a package originally intended for the management of terminology collections prior to uploading to a larger-scale databank, there is a substantial need for search tools, accentuated by the almost inevitable development of secondary uses for the system. A conventional database package answers these requirements (as indicated earlier) by searches which seek entries starting with the search term in a pre-established alphabetical index. This operation can be very fast. Unfortunately, it is seriously flawed for a text-storage system such as a terminology application. All too often, the search term will be found not at the beginning of an entry, but somewhere within an entry. Conventional databases do have mechanisms for this type of search in the shape of 'filter' or 'locate' functions. In general, however, these mechanisms have to scan every entry in the base using unwieldy sequential access routines. As a result, they work too slowly to satisfy users (especially in a network environment, where they often entail 'fetching' the whole of the database to the local machine). Additionally, their use is frequently less than intuitive (at least to those who think Boolean operators might be a kind of telephonist). Some systems (including the Commission's Unix-based local system mentioned earlier) endeavour to answer the problem by maintaining a secondary 'keywords' file listing each significant word in every entry in the primary file, together with pointers to the entry in the primary file, this secondary file being indexed in alphabetical order. Searches then operate on the secondary file, which returns references to the primary file. Unfortunately, there are several disadvantages to this approach. Firstly, some systems using the approach will only allow single-word searches, which is obviously a severe limitation for a terminology application. Secondly, it is very cumbersome to manage, either imposing a significant overhead in processing time if the secondary file is updated simultaneously with the primary file or compromising functionality if the secondary file is updated off-line (e.g. overnight – implying that searches will only operate correctly the day after data entry). Application maintenance also becomes more complex because of the link with secondary files. Finally, the keyword files are significant additional consumers of disk space.

To solve these problems, TMan now uses an implementation of a bought-in fast text search module, which allows terms to be found on the basis of each element in the question (separated from other elements simply by a space) occurring at some point in an entry. This logic is intuitively satisfying even to the most unsophisticated users. In the event of a search failing, a partial matches option is also available, which will find any entries containing one or more of the query elements.

Without going into technical details, this result is achieved by maintaining a very compact index of text signatures which acts as a filter, returning a list

and will then move on to the next matching entry if the first proves unsatisfactory. In practice, however, most users appear to prefer the slightly slower 'hitlist' search, which verifies all entries and presents a view of the database restricted to those entries matching the search criteria.

A further important feature in a system which allows a multiplicity of separate term files – in principle, one per terminology project – is the possibility of searching either a single file, several specified files or, indeed, all available files. The last option is particularly important for 'occasional' users, who may well have little or no idea where to search for the information they require. It also largely answers one of the main criticisms of maintaining multiple files in a local system, an approach which in our experience suits local systems much better than the single, monolithic file (which is, however, in its turn more appropriate to the central mainframe system).

Provision also exists for batch query sessions, allowing the user to pose a series of questions one after the other without waiting for the answers, which he will receive later as a printout or a hitlist file. In practice, however, this facility is of more importance in a large-scale system, or one where on-line response times are very poor. Of more interest for a local, project-oriented system are the text analysis routines outlined below.

Import and export of files in various formats: Given that TMan's primary function is to manage terminology collections prior to uploading to Eurodicautom, it is obvious that it must be able to produce files which can be uploaded without further manipulation. In addition, it is desirable that the system should be able to read and write files in other common formats, since the Commission's Terminology Unit endeavours to exchange data files with other organizations working in related fields. In this context, the system is able to access directly files in the formats used by well-known general-purpose packages such as DBaseIII and IV, FoxPro and Paradox, as well as importing and exporting files in two common data interchange formats (SDF and comma-delimited). More advanced facilities exist for interaction with Wordperfect files, but these will be discussed below.

File sorting facilities: In addition to the viewing of tion of list-type documents, routines not dissimilar to the 'report-writing' functions of general-purpose databases are used to generate fully formatted output (including a range of text attributes – bold, italics, etc. – and block protection to avoid an entry being split by a page or column break) in either raw order of input or numerically or alphabetically sorted order according to any field. The main difference from conventional reporting routines lies in the fact that the output is not normally sent directly to printers but rather to files in Wordperfect format. This has the advantage of permitting fine adjustments to be made within Wordperfect, which is designed precisely for the purpose of delicate text manipulation, rather than attempting at great expense (and probably only with limited success!) to provide the same functionality within TMan. It also avoids the listing-like 'look' still evident in the output of even quite sophisticated report-writers, notably through such relatively rare features as the ability to switch text attributes on and off **within** fields (e.g. just one word in bold or italics).

The second set of functions is unlike those provided by report writers, which normally expect each record to be output once only (though multiple output is conceivable, particularly in the case of relational designs maintaining a secondary, keywords file). The purpose of these functions is to generate fully crossreferenced output (i.e. lists containing an entry in the appropriate alphabetical location for each significant word in each primary file entry). Several variants are available to suit different purposes and/or user preferences. User-defined lists of 'empty words' for each language reduce the amount of 'noise' (pointless entries) produced and can also (at the user's choice) be ignored in alphabetical sorting (which results in a dictionary-like order generally preferred by customers). For many purposes, particularly where speed is of the essence, these lists (once again produced in the form of Wordperfect files) can be used without further processing, subject to the inclusion of a 'health warning' along the lines of 'Index generated by computer' at the bottom of each page. In the case of documents which are to be more widely distributed and therefore require more careful finishing, the raw index can be reworked in Wordperfect (which mostly involves the deletion of superfluous items plus the restructuring of some entries) and then re-sorted in TMan (whose sorting routines are more sophisticated and flexible than those of the wordprocessing package) before final printing.

Text analysis routines: This covers two groups of routines, the first endeavouring to at least partially automate the process of exploiting source texts for useful terminology or phraseology and the second using terminology collections as an aid in the preprocessing of texts before delivery to the translator. In both these areas, TMan clearly overlaps the functionality of workbench packages, though in ways affected by the specific features of the Commission's translation workload.

The most ambitious of the text exploitation routines is specifically aimed at identifying repetitive elements in groups of texts (available in parallel language versions as Wordperfect files) and adding these to a TMan file for later use in preprocessing of texts in the same, or a similar class. It should be noted that the repetitive elements may be of any length from several words upwards, thus distinguishing the approach from that adopted by certain sentence-based commercial packages, which tend to be more useful in the context of technical manuals and the like. In Commission texts, unfortunately, there are numerous classes of document with standard bodies of phraseology running into the hundreds or thousands of phrases, but the standard elements are commonly less than full sentences, thus making packages which use unprocessed bodies of parallel texts as their source ineffective because they are rarely able to operate with units of less than sentence length (except for discounting simple variable elements such as figures and dates). It should also be stressed that, at present anyway, these routines are not used for the constitution of vocabularies for full machine translation systems, in part because such systems have hitherto tended to impose the manual entry of such vocabularies, with additional lexical information required for their grammar rules.

Less ambitious but useful in a wider range of contexts is the routine which enables elements of a Wordperfect file to be added to terminology files simply by marking them within Wordperfect. Marking may take the form either of a specified text attribute or attributes (e.g. underlining – so as to extract all section headings from a document) or of Wordperfect's list-marking feature. This latter option enables a terminologist to reduce the initial stage of exploiting a document to simply highlighting on paper the phrases to be extracted, which a secretary will then list-mark in Wordperfect (in one or two languages) and automatically import into a term file, thereby minimizing both the effort of retyping and the risk of typing errors (which is increased in our environment by the fact that secretarial staffing constraints in the Terminology Unit imply some languages being entered by non-native speakers). Those terminologists who prefer working on screen can even reduce the marking process to a single stage.

The text preprocessing routines relate particularly to the types of text mentioned above – those which are neither sufficiently standardized to be coped with by the use of models in which only a few words need to be changed nor susceptible to reduction to an entirely standardized vocabulary and restricted grammar (as in the case of the AVIMA project) but do contain a substantial body of standard elements. It might at first sight seem that these texts would be prime candidates for full machine translation. Whilst this might be true in a few cases, it is not in many others, precisely because the purpose of full machine translation is to attempt to translate every word in the source document. The weakness in this for an organization such as the Commission is best illustrated by a concrete example – the monthly Bulletin of Community activities (a very real example since the Bulletin has been the subject of preprocessing for some time now – using Unix software tools but with data at least in part generated by TMan). In addition to its standard phrases (some three thousand of which have been identified for English alone), this publication largely consists of summaries of (or extracts from) material already published elsewhere in official (and frequently legally binding) versions in all Community languages. Even supposing that the machine translation system were to produce valid renderings for these parts of the text, they would be unlikely to correspond to the official versions published elsewhere (and unlikely at any time in the near future to themselves be the subject of full machine translation!). It would, for instance, be impolitic at the least for the Commission to translate the summary of a European Parliament resolution in ways at variance with the Parliament's own translation of the full resolution. This in turn means that translators would be obliged to spend much of their time undoing the work of the machine translation system – and inexperienced translators in particular might well be led into a false sense of security, accepting more of the machine version than was advisable. All of this leaves aside the fact that machine-translation systems have not so far proved especially good at coping with the type of non-controlled language prevalent throughout much of the Bulletin.

Preprocessing using standard bodies of terminology from a TMan file avoids both of these dangers, allowing the machine to do what it does best – recognize standardized elements and translate them with total consistency – whilst leaving the rest to the still much more flexible tool of the human brain. In addition to the possibility mentioned above of using TMan-generated material in an external preprocessing package, TMan itself possesses three internal preprocessing options, each designed to process either Wordperfect files (maintaining formatting and attribute information) or straight text files. The first of these options produces, on file or paper, a text-related glossary listing all the terms from one or more TMan files found in the target text. The second produces essentially the same information, but this time intercalated at appropriate points in a copy of the target file. The final (and most ambitious) option produces a copy of the file with all standard phrases replaced by the appropriate phrases in the target language (thus yielding a text in, for example, mixed English and French). In particularly productive cases, whole paragraphs or pages of this preprocessed output file may be used in the final translation with little or no change, thereby saving both translation and typing time.

There are, of course, weaknesses with such preprocessing options. In the first place, the full replacement routine is currently limited to using a single TMan file because it (unlike the other options) requires replacement of the longest matching phrases first (a process which would be substantially complicated by the use of multiple files). A second weakness lies in the limited extent to which morphological reduction (e.g. correct recognition of both singular and plural noun forms) and sentence reordering are implemented. Some rules are applied to improve performance in both these areas. Nevertheless, it is arguable that more sophisticated rules might bring significant benefits in, for example, the case of the German/English language pair, where sentence order differs systematically and one of the languages is highly inflected.

A caveat should be entered here, however. Because of the challenge inherent in devising rules to cope with these situations and the satisfaction to be achieved by overcoming the difficulties, there is a danger that system developers will lose sight of the harsh realities of cost-benefit calculations. Particularly where the purpose of a routine is to replace standard phrase elements, the number of variants actually encountered in practice may be quite small (often no more than two or three). In this case, providing an efficient file format is used and copy routines are available to minimize manual re-entering of data, it may actually be more rational (though less elegant and intellectually satisfying) to maintain separate term file entries for the common variants rather than expending substantial effort on the development of sophisticated grammatical rules. A few simple, but high-productivity rules (which may not even be 'correct' in the strict sense) are probably all that is worthwhile in the early stages. Beware especially of implementing any rules which will require users entering terms to specify parts of speech, gender or other grammar-related information. Hard experience suggests that, faced with such requirements, most users will simply abandon (or radically cut back) their data entry efforts. Even terminologists will complain vociferously.

THE BOTTOM LINE

So much for TMan as it now stands. Some of the prospects for future development can be inferred from what has already been said. For the remainder, matters are very much in the lap of the Gods. Precisely because of the options chosen, however, we can view a situation of uncertainty with some equanimity. Even if the Unit were obliged to abandon the system at relatively short notice (an unlikely prospect), all data could be recuperated without difficulty, no expensive hardware or software would have been wasted, and the savings already achieved would be sufficient justification for the (limited) resources expended. But what of the lessons for others?

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In-house development not for everyone. By reason of the particular combination of requirements facing the Commission's Terminology Unit and the confluence of a number of fortunate circumstances (most notably the availability of on-the-spot programming expertise in a computer language permitting rapid application development combined with a reasonable level of performance), in-house development has proved a viable option for the production of a highly customized system. It is also notable that a number of other international organizations (the FAO for example) have followed a similar path, even to the extent of using the same application development language. Specialized dictionary publishers (who may well have index-production needs similar to those met by the Commission's application) could probably also benefit from this approach – unless and until a commercial package appears which really brings an acceptable level of functionality to the lexicography facet of terminology work. For the average organization, however, it may be wizer to regard our experience more as an indication of what might be demanded of a commercial package (though almost inevitably with some compromises) or of a commissioned systems developer. If the in-house or commissioned development options are chosen, several key points must be borne in mind.

As far as in-house work is concerned, choice of computer language and development tools are critical. Management would be unwise to forget the computer enthusiast's tendency (familiar to the author as precisely such an enthusiast himself!) to underestimate the difficulty of a project whilst simultaneously overestimating both his own programming knowledge and the power of his favourite language and development tools. As a rule of thumb, suggestions that high-performance multiuser applications can be built with any version of Basic (even the latest Windows incarnations) should be treated with the greatest caution. Performance problems also exist, as mentioned earlier, with most 'interpreted' database programming languages, which may in addition straightforwardly lack the means for implementing certain functions at all (and not be open to the addition of such functions through 'bolt-on' modules). At the opposite extreme, application development using the most popular 'professional' languages – C or C++ – is both complex and highly time-consuming even for the most experienced programmer, not only making initial development costly (often unpredictably so) but also rendering ongoing development cumbersome at best. It is not unknown for the experienced Clipper programmer to be able to add in half an hour a function which will take a C programmer days (albeit the result in C will normally run faster – though even this may be imperceptible given the possibility of bolting C modules onto Clipper applications for speed-critical system components).

Similar considerations apply when commissioning outside developers. In this context, project specification and performance guarantees may be critical if the customer is not to end up with a system which will fly supersonic fighter missions with all the speed and grace of a Graf Zeppelin. Computer professionals too can be guilty of underestimating the problems involved in language industry applications (especially on their first venture into the field and with the prospect of a juicy contract dangling in front of them).

Whichever path is chosen (and whatever their shortcomings one of the specialized commercial packages is probably at present the best option for most individuals and small translation, terminology or lexicography operations), there is little doubt that language industry professionals should be expecting great things of the microcomputer over the next few years. In particular, it seems to the author that if an in-house package developed by a single part-time programmer can, for instance, be made to operate directly on files in the most complex of wordprocessing file formats, the customer should begin to demand this of commercial products. Also expect more in the way of text preprocessors, text analysis tools and perhaps dictionary publishing software (though this last market niche may be too small for rapid progress). Increased user pressure for developments in these directions would at all events help to promote the much needed shift in emphasis from the computer as a replacement for the language professional to the computer as an *aid* to language work.

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Accounting for the value of information

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The status of information

A systems engineer looking at information sees informatics. That means 'the design, construction, evaluation, use and maintenance of information processing systems including hardware, software, organizational and human aspects as well as the complex of their industrial, commercial, administrative, social and political impact'. (The 1978 IBI-UNESCO Conference on 'Strategies and Policies for Information').

That is quite a tall order, but it accords well with the realization that information is more than a resource to be communicated along wires or on paper. Information permeates all organizations; it is the raw material of cognitive activity; the internal information network binds an organization together; and information is the means whereby the organization obtains its window on the world. Libraries too are part of the knowledge and technology domain; they use technology, and they are the final repositories of human wisdom. In the scheme of things information managers and technologists are therefore rather important people.

The status of information management is undermined in practice because it is difficult to ascribe value to information and knowledge in conventional economic terms. The financial director and the production manager can point to the large amounts of capital and cash flow for which they are responsible. But what does an information services unit or an internal information system actually do? They generate costs, but what is their return on investment, what is their value?

The vital resources for a business are knowledge, money, information and intelligence. Money itself is a form of information, but an odd one because this 'information' can be traded in its own right and used to measure the value of all sorts of things and activities – except information! Financial decisions as to what is or is not justifiable with respect to investment in knowledge workers, systems, libraries, databases can go sadly wrong in the absence of criteria that can place information value alongside money value.

This state of affairs will continue until such time as a form of 'information accounting' is generally accepted that is as valid as money accounting, but has the added value of being able to deal rigorously with intangible assets and information. Or to put it brutally – a profession that does not really know how to value itself and its products is not going to be listened to very carefully, however grand the definition of informatics may sound. Real answers to questions about the value of information, indeed about valuation methodology in general, are of critical importance to information management. There is a crying need for methodology that can deal robustly with intangible value within an accounting framework. Successful answers will mean that the true value of information to an organization will be recognized, information management will move nearer to centre stage, and information managers will become the corporate experts on general value problems and methodology.

This paper introduces some structure to questions of defining and measuring the value of information. Indicators are not enough on their own: a complete accounting framework is required that incorporates a treatment of intangible value that is so rigorous that it has to be accepted as an equal partner to monetary value. Such a framework must lead inevitably to some increase in complexity as value-in-the-large is a multi-dimensional construct for which money value is only one dimension. However the conceptual difficulties become manageable if one goes back to the beginning and finds answers to such questions as:

> What exactly is information?
>
> How does it contribute to the success of an organization?
>
> How does one construct a value calculus that deals rigorously with both monetary and intangible value within a common value metric?
>
> How does one present an abstract multi-dimensional value space that will not put a layman off his food?

Some answers to those questions are provided, and the construction of an integrated value methodology that is rigorous, operational and user-friendly is shown to be feasible. An operational form of this methodology has already been used in the professional field on several awkward problems in which the value of intangible assets and inputs was critical. To achieve this the methodology pulls in the analytical resources of systems engineering, which is not shy of heroic mathematical modelling and knows how to deal with quantifying the value of uncertain non-commercial outputs. It takes some courage, but an electrical engineer experiences little difficulty with the intangible nature of information, as electricity is a commodity whose effects and costs are very observable but which is itself even more invisible than information!

The measurement of value

Money supplies only one dimension of value. This has been enough in the past for conventional business and cost accounting. But it is clearly no longer adequate when information with its awkward intangible properties is such an important corporate resource, when business must increasingly subscribe to social and environmental audits, and when 'value for money' is proclaimed as the ultimate virtue. Accordingly the hunt is on for an accounting framework that can bring many value dimensions, monetary, tangible and intangible, into a unified value space that is readily understandable, usable, and still makes sense in conventional accounting terms. The proper evaluation of any subject, thing or concept will be a complex process if the value set contains more than one value dimension. The requirements for a rigorous multi-dimensional value measurement system should be clearly understood before embarking on the construction of a credible valuation process, otherwise the result may be somewhat ad hoc. These requirements will also set the agenda for establishing a means for measuring the value of information.

There are three essential requirements:

1. Subject definition

A clear definition of the subject with a set of indicators that describe, inclusively but independently, all its value contributions towards the achievement of its objectives and the attainment of the 'ideal'.

2. Definition of an ideal

A clear definition of the ideal against which the subject is to be judged. This can be interpreted as an inclusive and objective value field that the context of the subject implies. If the subject is a human activity (business, organization) the mission statement and its objectives form a value sub-set.

3. Comprehensive evaluation criterion

An operational procedure for assessment and evaluation that:

(i) embodies the implications of the value field, whether objective or subjective;
(ii) receives the indications of all the value contribution from the subject;
(iii) combines the contributions in a manner that is rigorous with respect to the logics of value and measurement;
(iv) produces an overall figure of merit that is a proper and inclusive indicator of the combined value of the subject with respect to the stated value field;
(v) allows this combined value to be compared to monetary value in a meaningful manner for financial and decision purposes.

Stripping the subjective and intangible elements out of this framework reduces it to the familiar ground of monetary or physical measurement. The comparison in (v) can only reflect the intangible component in combined value as quasi-money, but the comparison is rigorous if it is effected within the logic of multi-dimensional value spaces, (which is not the same as cost benefit analysis). It is no use pretending that intangible value can be converted directly into conventional accounting value – if it could there would be no problem.

Understanding information: models of the information process

The first step towards the construction of a valuation process for information is a definition of what is meant by the information or information processes that are to be valued. Many authors have been here before: for an excellent review see (Poirier 1990).

A somewhat different standpoint is adopted here: that of large scale systems Engineering with its process models and the recognition that to understand a part, one must also understand the whole and the context of the part in the whole. This whole-picture analysis is particularly important when it comes to assessing the value of things that have a distributed effect within an organization. For example, the cost justification of automated manufacturing systems is difficult if the analysis examines only the immediate factory context. But the equation changes radically when the attendant impacts of the new capability are traced through the organization, and all the accruing advantages are compiled (Primrose *et al* 1985). This must surely apply to information processes as well.

Three models are examined briefly in order to define the contributions that information processing makes to the achievement of human activity, thereby adding value (of some sort). The first model looks at the cognition process. This essential model of an information process reflects the support given to the act of human cognition whereby the 'state of knowing' is enhanced. The first model sets out to operationalise this process. But any resulting value added inside the human brain is not realized until it is converted into some form of external activity that works towards the achievement of recognizable objectives. So the second model looks at the corporate information process and the support given by information to the achievement of corporate goals. This leads immediately to the third model, a simple model of conventional value added accounting, which highlights why conventional accounting misses the vital contributions provided by information and knowledge work.

These three models enable the first two requirements of a valuation process to be met: a complete understanding of 'the subject', and a definition of 'the ideal'. Thereafter the necessary framework for measuring the monetary and intangible contributions from informational activity more or less defines itself – (with a little help from value theory, measurement theory and decision theory).

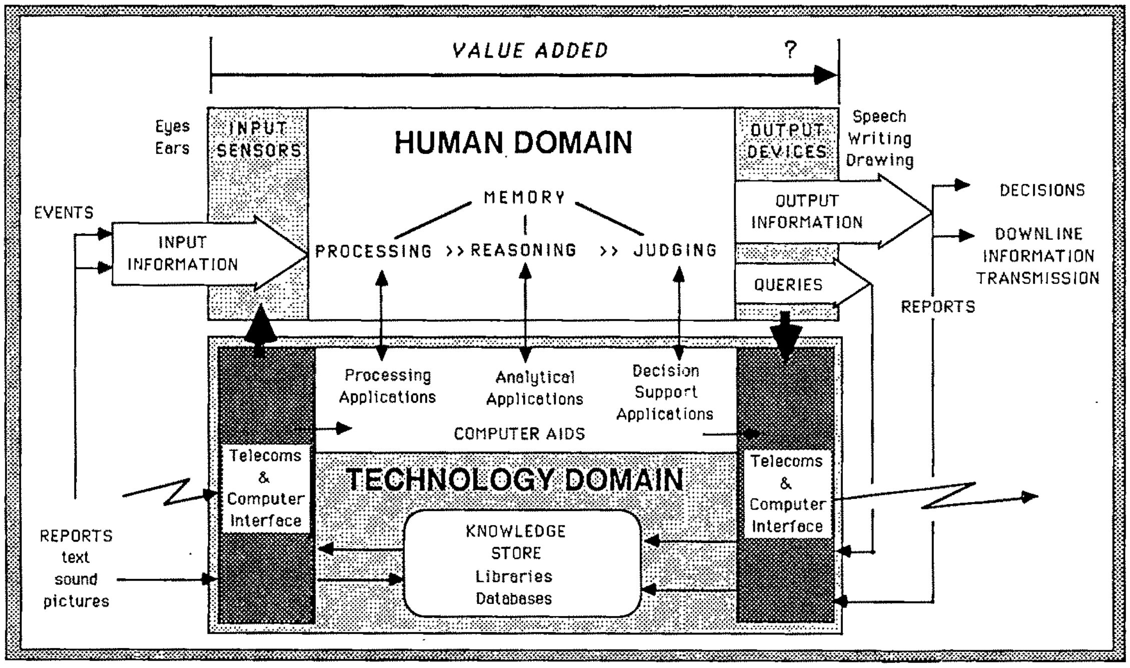


Figure 1: Cognitive model of the information process

Model 1: the cognition process

The cognition model is illustrated by figure 1. Here the human cognitive domain of processing >> reasoning >> judging is supported by a parallel chain in the technology domain, where human memory is also reinforced by access to libraries and databases. Human-computer interfaces supply the links between the two domains, along with telecoms for all the messaging requirements. That interface can now be extended to include multimedia presentations of information and knowledge.

The model makes an important observation, and asks a question.

From a systems point of view Information Management (IM) and information systems (IS) are observed to be important parts of the unified technology that supports the cognitive process: they both lie within the technology domain (= informatics domain) and are interdependent. The information manager, *who should know the information requirement profiles of the knowledge workers,* is deployed to help the knowledge worker gain access to, and digest, appropriate information from scattered sources. The information systems technologist provides the technical means for communicating, computing, networking and interfacing. Seen like this IM is the more important function as it deals directly with the information and knowledge requirements of the user. IS also has direct contact with the user via the desk terminal, but this contact is technologically enabling, and does not provide the close-up personal service.

The functional cooperation between IM and IS points to the emergence of 'really integrated systems' – in spite of all the current difficulties (Brittain 1992). These difficulties will tend to disappear once IM and IS develop a professional correspondence, and integrated systems are specified with respect to the informed user's actual requirements and expectations. The future looks interesting.

The model also implies the question about how the value added by the cognition process is recognized. The value of the information must surely be enhanced because of the transformations that occur between the input and output: there is a new state of knowing. The categories of value added will depend on the nature and quality of the enhancements that are realized because of the support of the Technology domain (that is from IM and IS). These enhancements fall into four categories:

Cognitive Enhancement

- Integration
  - Integration of systems and apps.
  - Managed communications
  - User-focussed provision and presentation
  - Multimedia HCI
- Productivity
  - Fast access/search
  - Applications
    - Processing
    - Analysis
    - Document mng't
  - Network linkage
- Knowledge
  - Situational awareness
  - Analytical/diagnostic power
  - Computer integration and correlation of multiple data feeds
  - High level info. integration via correlation and advanced graphics
- Decision
  - Integration of multiple issues
  - Reduction of uncertainty
  - Greater sensitivity to multiple values
  - Better decisions
    - Diagnostic
    - Operational
    - Strategic

The realizable value added resulting from these enhancements will depend on what they are contributing towards (user satisfaction is only one of the entrained objectives). Consequently the value criterion must depend on the contributions towards the achievement of external operational and organizational objectives – so the argument moves on to the value of knowledge and information to the organization.

Some idea of the scale of the value that can be ascribed to the supply of good fast enhanced information can be obtained by looking at the military. Here competitive advantage and survival are of the essence – as they are supposed to be with business. The command information system in a modern frigate costs about one eighth of the whole ship development cost (excluding the weapons). The subsequent total life-cycle cost is four times larger. So the 'ownership cost' for good information provision adds up to about half of the capital asset value of the warship[1]. That is a lot of money.

Model 2: the corporate information process

The next model places information in the context of a business producing products for sale, but the model is still general as the products could be, e.g., advertising copy, legal instruments, or knowledge. Figure 2 illustrates the model as a nest of functions necessary for the implementation of the business, with production processes on the left, and information processes on the right. The corporate information system (CIS) incorporates all IM and IS supported activities; it has a formal system structure alongside the informal structure of human contact. Information processes permeate the whole organization – affecting just about every activity and result.

The model makes several points:

1. There is an interesting similarity between the chain of operations within the production process and the information process. Both are production processes adding value to 'material' – a useful analogy which can give structure to the consideration of information processes.
2. The corporate information system should be regarded as the whole-information process within the organization. It incorporates both the IM and the IS functions (as discussed earlier) and it contains subsystems tuned to address the needs of each layer in the organization: strategic, managerial, operational.

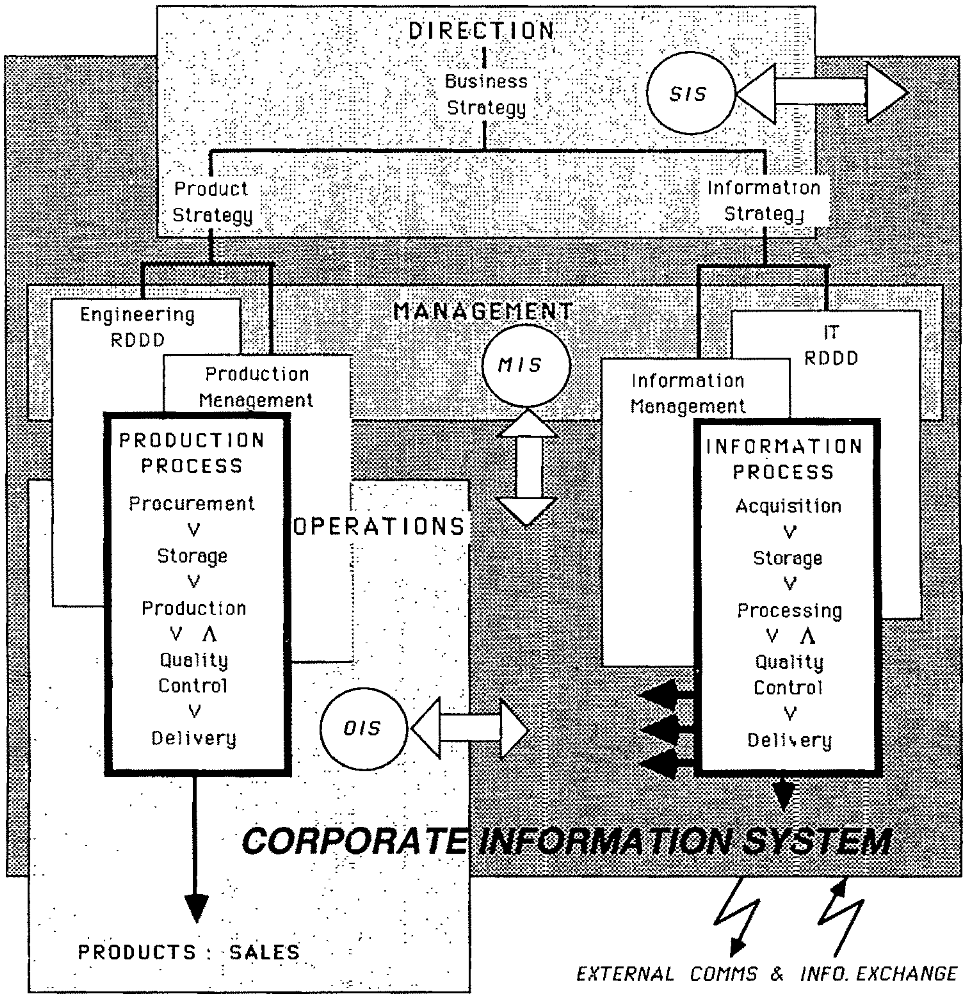


Figure 2: The corporate information model

KEY: RDDD = Research, development, design, deployment SIS = Strategic information system
MIS = Managerial information systems OIS = Operational information systems

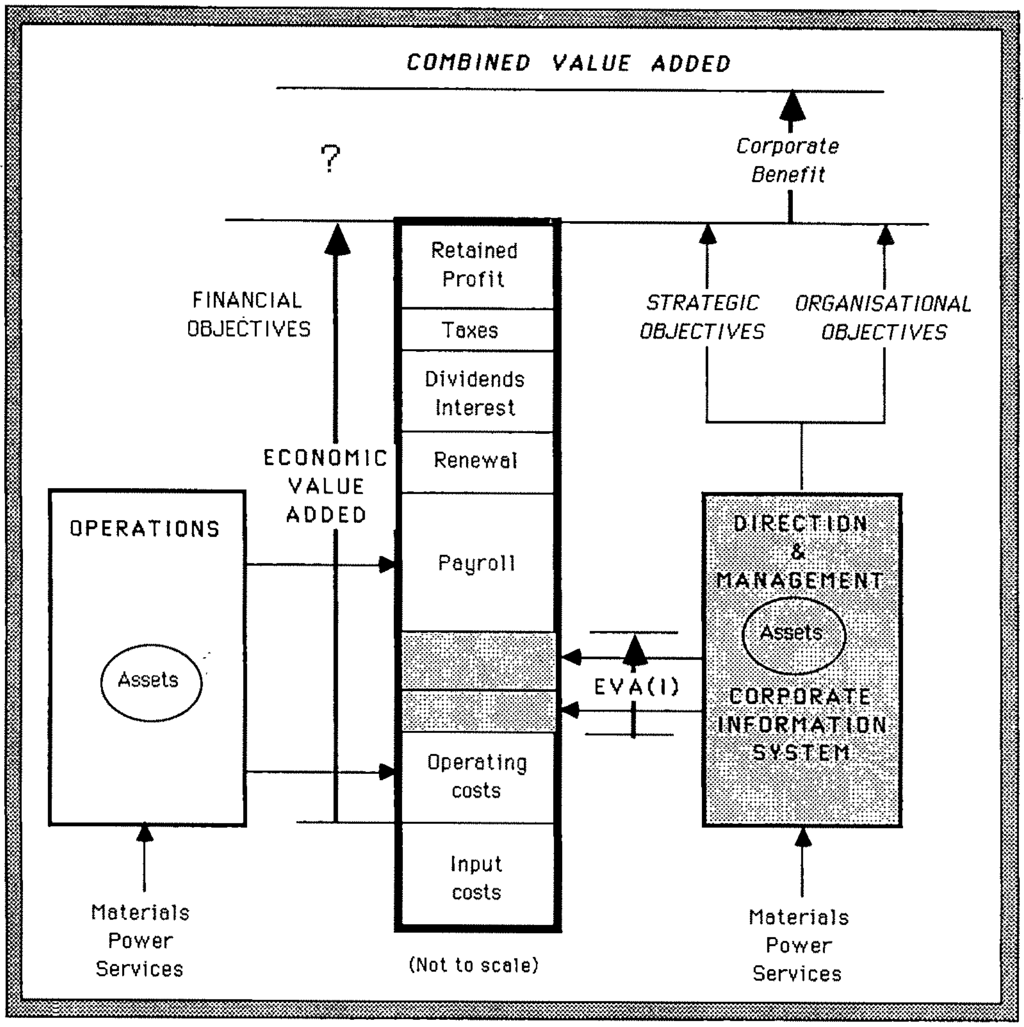


Figure 3: Simple value added model

3. The CIS is the network that provides the linkage between the layers and the functions. The inherent hierarchical structure is clear, although the lateral connexions turning the structure into a matrix are only implied. In effect the CIS is the embodiment of the organization's structure. It is information that holds an organization together.

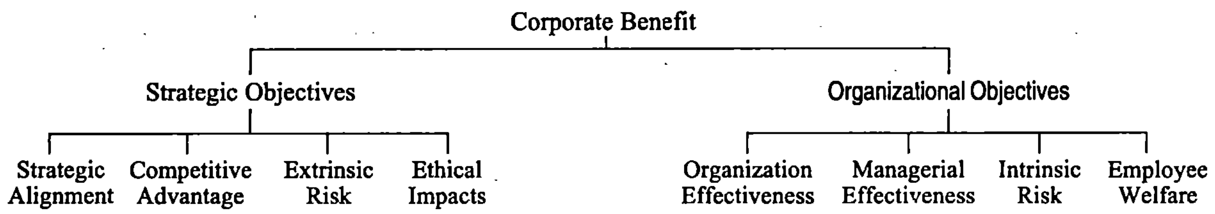
4. The organization's overall business strategy includes two technology strategies: one for the production and operational functions, the other for the information function.

5. *It is self-evident that the joint purpose of the informational functions is to enable the business to deliver the strategy and achieve its objectives by:*
   - *(i) cognitive support – ensuring that the information needs of the human agencies at all levels are met,*
   - *(ii) strategic and operational support – coordinating, integrating and securing the information flow from strategic direction to management to operations, and back.*

That information and knowledge are vital strategic resources for an organization is beginning to be well understood (Broadbent 1991, 1993, Fitzgerald 1993). In this context the value of the CIS, with its contained information, stems from the contributions that it makes to the achievement of business strategy and the overall mission. This is not a narrow definition limited only to the strategic level and to the profit and loss account. In compliance with the systems engineering approach it covers the whole system: each and every part and function in an organization must justify its existence by virtue of its contributions to the cost-effective achievement of the organization's existence, survival and objectives.

Model 3: a simple value-added model

Conventional accounting contains several flaws when it addresses the value added by informational activity, whether in monetary or quality terms – as is recognized in both the accounting and information literatures. Value added (VA) in company (or national) accounts is defined as turnover minus the cost of bought-in (imported) inputs. This is designated here as economic value added (EVA) to indicate that it is compiled in economic (monetary) terms – and to distinguish it from the other types of VA that are going to be encountered. The central column of the model, figure 3, lists the components of EVA.



The figure makes several points, asks a question, and suggests an answer.

1. The cognitive effort of management and the outputs from all informational activity are measured only as the costs of the associated salaries, equipment and software. The costs are indicated as EVA(I) and shown shaded in the figure. EVA(I) is a component within the overall EVA.
2. Because EVA is cost oriented it cannot recognize the output value of the knowledge and information processes if the output is 'consumed' by management internally.
3. Consequently the monetary value of any productivity or quality increase due to improvements in management effectiveness and the CIS will go largely unnoticed. It would be different if the output was in the form of reports sold to external customers: now the augmentation in monetary value would be noticed immediately.
4. The question asked is how the cognitive and information contributions to the business can be valued.
5. Suppose that the inclusive corporate objectives are broken down into three subsets: financial objectives, strategic objectives and organizational objectives. Economic value added can now be regarded as one of the measures of performance targets set with respect to financial targets. On its own, EVA does not yield any measure of how well the business is doing in meeting its external strategic targets or its internal organizational targets. EVA is just an accounting statement[2].
6. The element missing from EVA may be called the corporate benefit that comes from concurrent satisfaction of the sets of strategic and organizational objectives. *These two sets are supported directly by managerial and informational activity.*

The answer to the question (4) is found if the contributions of management and information to corporate benefit are made explicit. That suggests that a new value dimension should be introduced which can be placed on equal terms alongside EVA so that the *overall* value added to the business can be evaluated. This overall value is referred to as the combined value added.

The meaning of 'corporate benefit' in terms of strategic and organizational objectives has to be defined. This requires the development of a breakdown hierarchy which structures the meaning down to an operational level at which measurements and assessments can be made. The start of such a hierarchy is shown below. The third level comprises a rational inclusive set of objectives, the individual

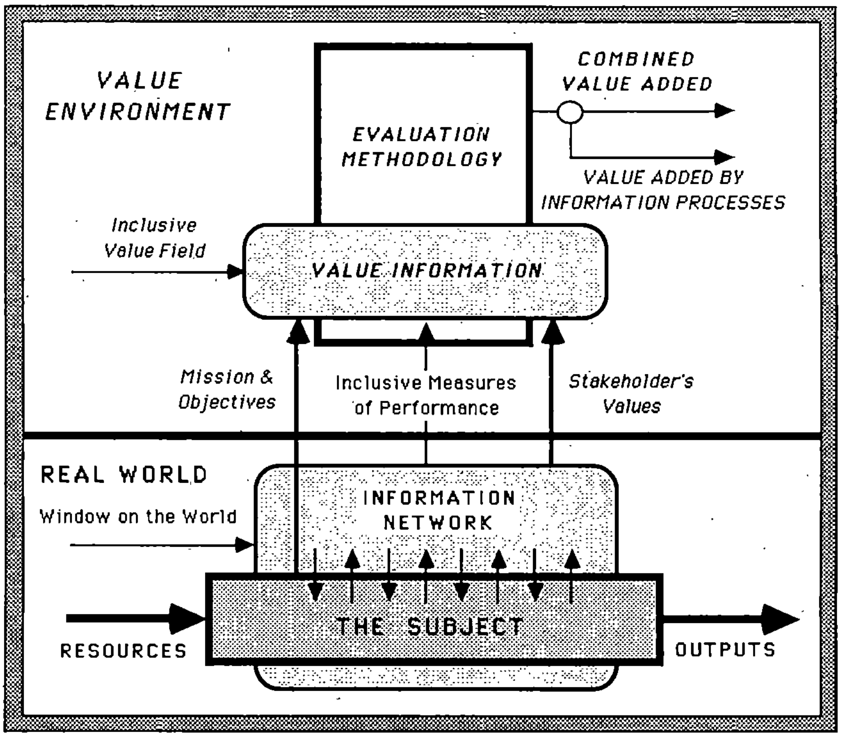


Figure 4: The role of an evaluation methodology

elements of which can be broken down further according to the particular context.

The value of information in reducing uncertainty and risk

The important relationship between information and the reduction of uncertainty and risk seems to be largely ignored in the IM literature. The value of these contributions can be significant as good information reduces the probability of future losses due (i) to ill-formed judgements of future developments and (ii) to the non-delivery of output (with respect to time and quality). Information systems also have their own unreliabilities to contend with, which may increase rather than reduce the levels of uncertainty and risk.

The management of risk and uncertainty figures strongly in investment analysis, systems engineering and management science, and their methodologies can be commandeered. Effectiveness is the probabilistic measure of overall system success with respect to the expected achievement of its operational goals. Another name for this is risk – the probable cost of non-achievement due to internal factors (which ought to be under control) and to external factors which are beyond the organization's control.

Any increase in organizational effectiveness, or indeed of informational effectiveness, is an important factor in the value of information and should be included in the analysis of information value.

An integrated methodology for evaluation

The two models of information have provided an understanding of how value is added to an organization by the activity of knowledge workers with the support of good information. The third model on value adding has suggested how the value of information might be considered in order to get round the defects in conventional accounting. What is needed now is a methodology that will provide the functionality suggested in figure 4.

All the information about the contributions to value within the system, organization or business under scrutiny (called the 'subject') must be collected, assessed and judged by a comprehensive criterion. The criterion itself should be inclusive and represent the subject's objectives together with any additional objectives to cover stakeholder (and ethical) interests. The evaluation generates an indication of combined value added (CVA) which is the conflation of monetary and intangible value components that arise from the relative achievement of financial, strategical and organizational objectives. That part of combined value generated by the contributions from the information processes in the Subject is the focus of interest for information accounting.

It is always important to have a very clear structure of the elements of value when dealing with complex value problems – otherwise the debate and the consequent evaluation will be inconclusive. So the starting point for the development of a methodology for information accounting must be a hierarchy of information value that disaggregates value itself into its fundamental compartments, breaks these down to include the components of information value, and goes on to assemble the final indicators of value that will provide the inclusive answers to the evaluation problem. Such a hierarchy is shown below in figure 5. This is an outline only for illustration with much detail omitted.

At the top of the hierarchy value is divided into the two fundamental aspects that particularly concern information: instrumental value (contribution to the achievement of organizational objectives), and intrinsic value (the value of the availability and potential capability of information resources). The two other value fundamentals – aesthetics and ethics – are not shown, although they are implied in the hierarchy and can be made explicit with a more detailed analysis. The next level down lists the three operational categories of value: financial, strategic/organizational and fuzzy. The last is an interesting category as it provides a home for those awkward attributes that are difficult to define exactly, and contain both instrumental and intrinsic value. The fuzzy categories are dealt with by sending their contribution to the other categories according to their membership of them.

Some of the main indicator headings are listed below each category. From then on the hierarchy deals with the business of allocating the categories to value terms that can be estimated/calculated in the real operational world. The structure and terms shown are those used in the integrated value methodology that acts as an operational expression of the 'comprehensive value criterion' as defined at the beginning of this paper.

The internal design of an integrated value methodology (IVM) is determined by the requirements that it has to meet – it designs itself into five stages as listed below and outlined in Figure 6.

Stage 1 Define the 'evaluation context', i.e. subjects, objectives, indicators
Stage 2 Estimate the monetary component of value added (ref financial objectives)
Stage 3 Estimate the overall worth of the intangible contributions (ref strategic and organizational objectives)
Stage 4 Estimate the combined value added (a logical function of monetary and intangible value)
Stage 5 Integrate the value estimates to relate the intangible within the financial framework.

The IVM must adopt a top-down approach and start with the definition of organizational objectives (Stage 1). These in turn define the necessary and sufficient indicators of the information contributions, i.e. information objectives are a sub-set of the organizational requirement. The defined indicators

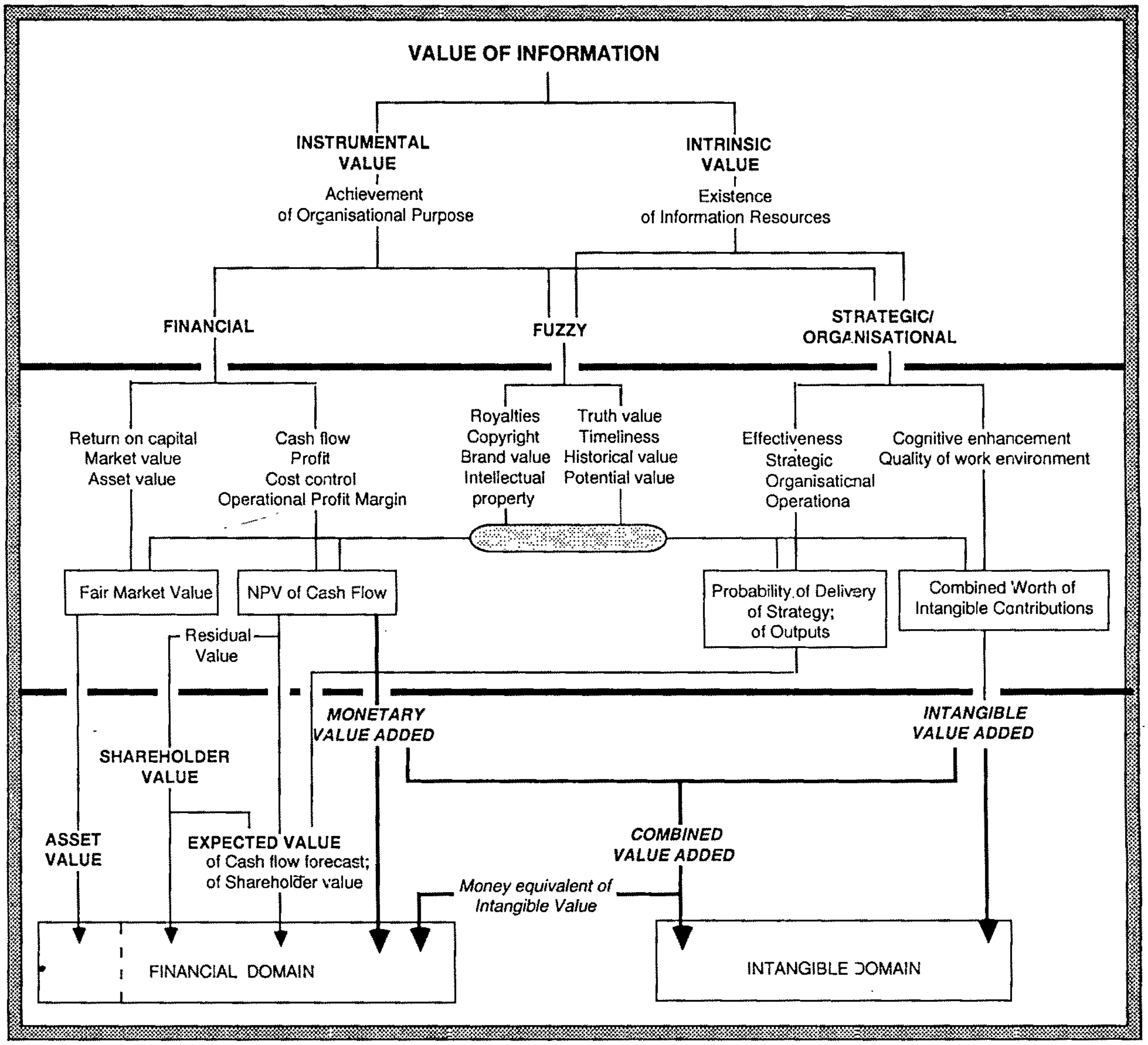


Figure 5: Value hierarchy for information

KEY: Top level = value categories Middle level = operational indicators Lower level = aggregate estimates (Thick arrows for the main estimators of the methodology)

provide the inputs for the analytical stages which implement the 'comprehensive ealuation criterion' in an operational form so as to generate the required outputs.

The required indicators of aggregate value added are monetary value (from Stage 2) and intangible value which is the properly combined aggregate of all the intangible contributions (from Stage 3). The effectiveness stages are shown for completeness only: Stage E1 deals with effectiveness modelling, and E2 with risk analysis.

Procedures must then be provided to deliver Stages 4 and 5 whereby the monetary and intangible values are compared and integrated within both an absolute and financial framework. The absolute framework is required so that monetary and intangible value can be viewed and understood within a properly defined logical value space, while the financial framework allows the monetary equivalent of indicated intangible value to be brought back into the financial domain.

It is easy to specify such a straightforward system in the abstract. It is not so easy to implement in practice as intangible value is not deemed to be a serious quantity that can be treated with objectivity and scientific rigour. Or can it be so treated?

Thinking about intangible value

Stages 3, 4 and 5 of the IVM are absolutely crucial as it is within these that the vexed problems associated with the measurement and evaluation of intangible value (= information value here) have to be addressed. Intangible value is different from monetary value: it is difficult to think about, difficult to measure, difficult to combine both within itself and with monetary value. *But it has to be said* that the conceptual difficulty occurs only because it is customary to think of 'value' in terms of the single money dimen-

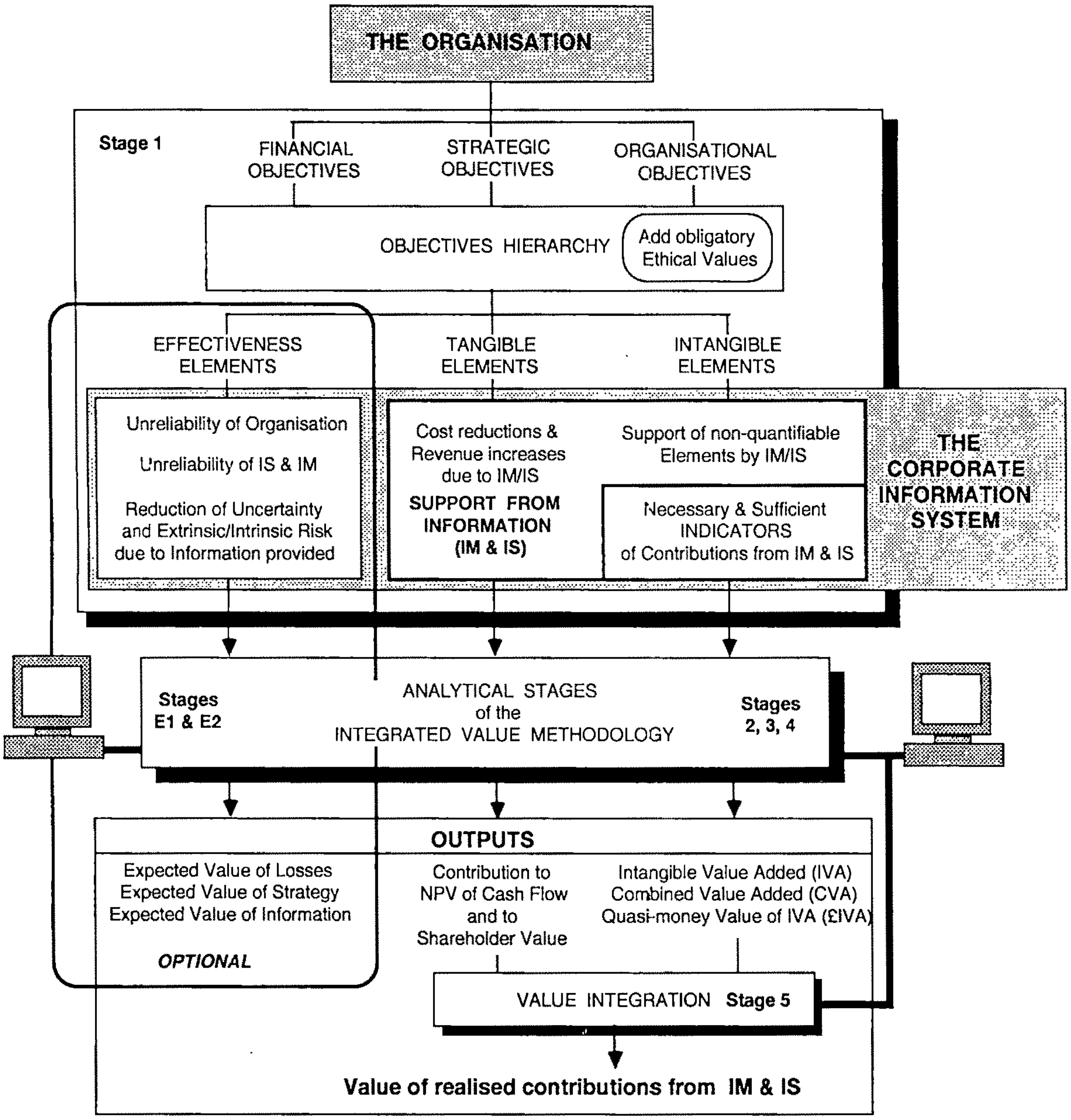

THE ORGANISATION
Stage 1
FINANCIAL OBJECTIVES
STRATEGIC OBJECTIVES
ORGANISATIONAL OBJECTIVES
OBJECTIVES HIERARCHY
Add obligatory Ethical Values
EFFECTIVENESS ELEMENTS
TANGIBLE ELEMENTS
INTANGIBLE ELEMENTS
Unreliability of Organisation
Unreliability of IS & IM
Reduction of Uncertainty and Extrinsic/Intrinsic Risk due to Information provided
Cost reductions & Revenue increases due to IM/IS
SUPPORT FROM INFORMATION (IM & IS)
Support of non-quantifiable Elements by IM/IS
Necessary & Sufficient INDICATORS of Contributions from IM & IS
THE CORPORATE INFORMATION SYSTEM
Stages E1 & E2
ANALYTICAL STAGES of the INTEGRATED VALUE METHODOLOGY
Stages 2, 3, 4
OUTPUTS
Expected Value of Losses
Expected Value of Strategy
Expected Value of Information
OPTIONAL
Contribution to NPV of Cash Flow and to Shareholder Value
Intangible Value Added (IVA)
Combined Value Added (CVA)
Quasi-money Value of IVA (£IVA)
VALUE INTEGRATION Stage 5
Value of realised contributions from IM & IS

Figure 6: Outline of the integrated value methodology

sion, a heresy that is reinforced by management texts most of which treat utility as only the utility of money. The result is a certain amount of anguish when other values have to be considered which are not readily measured in money terms, as is demonstrated by the current efforts to bring intangible fixed assets, information value, and environmental and ethical values within a financial accounting framework.

These difficulties can be handled quite satisfactorily and rigorously within a methodological framework that calls on appropriate parts of value theory (axiology), measurement theory (utility and preference with non-additive representations), decision theory (multi-criteria decision problem)[3]. *But it has to be said* that these topics are not exactly predominant in the syllabuses that accountants and managers are normally exposed to.

There is another problem. To think of value in more than one dimension requires a facility for spatial visualization associated with multi-dimensioned spaces. Such thinking is formally developed in science A levels and university courses in engineering, physics, mathematics and mathematical economics and in many of the life sciences. In fact spatial thinking in multiple axes is being employed by anybody who is able to read a contoured map and visualize the shape of the terrain, and by people who can look at an engineering or architectural drawing and see the implied shapes. Accordingly it can be argued that multi-dimensional spatial thinking is not difficult. *But it has to be said* that formal spatial analysis is not familiar to the majority of people professionally engaged in accounting, financial management, and for the politicians who make the decisions.

A fundamental problem that cannot be skirted round is that of combining unlike value streams. Most methodologies end up with some form of scoring method, which implies additive combination. Unfortunately values only add together if they are strictly substitutable – even money does not qualify if money streams separated by time or currency boundaries are to be combined, hence the various devices of discounting which are a form of combinatorial arithmetic. What, for example, is the meaning of the attributes 'accuracy' and 'security of information' when combined? Added value certainly results, but with what metric and how much? It can be shown that the trade off between value combinations answers such questions by defining a proper logical space in which a set of combinatorial rules express the meaning and consequent quantity of combined value, given the definition of the inputs.

Finally there are the constraints of the legal audited account and balance sheet. It is very difficult to squeeze intangible value into these. But the need to do so is now admitted and the search for methodology is being actively pursued in many fields: intangible fixed assets (accountancy), alternative economics (social and environmental audits), new inclusive measures of success for the modern business. It is clear that a methodology that deals properly with intangible value and value combinations introduces several conceptual difficulties into conventional accounting. The additional complexity will have to be justified by the merits of the methodology.

A combined value calculator

Anybody who has tried to teach mathematics in a business school has experienced the resistance of the modern student to being taught the detailed procedures of quantified analysis when the answers are readily available with a pocket calculator or personal computer. After one has learnt the 'why' of the time value of money, why go to the bother of learning the 'how' of all those complicated discounting formulae when the calculator is going to be used anyway? An advanced motorist does not need to know how to design the engine.

The same thinking probably applies to the case of intangible and combined value. Once the need is admitted, and the rigour of an evaluation methodology is generally understood and accepted as valid, the practitioners will be as happy to use a computer-aided methodology to indicate 'total value' as they are now when using financial spreadsheets to calculate money value.

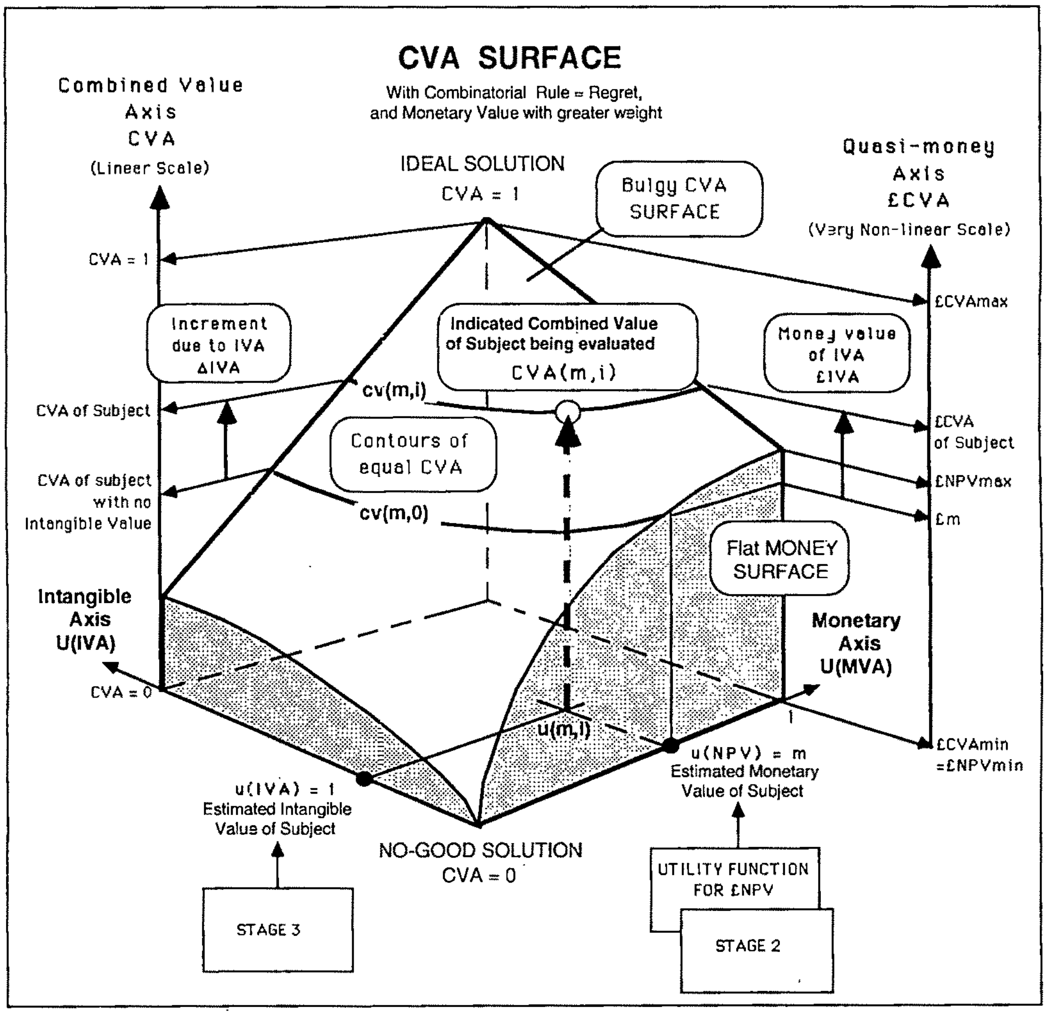
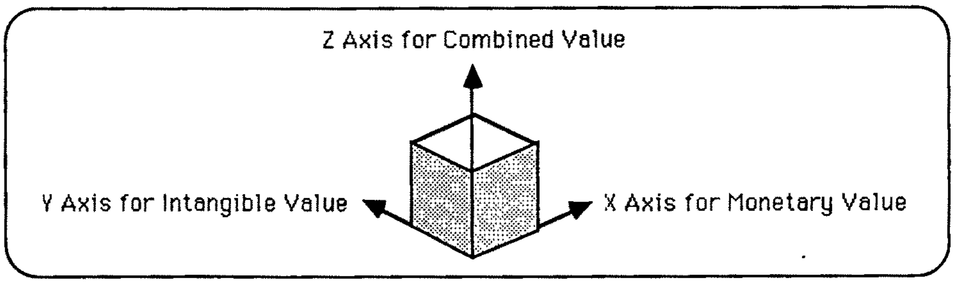


Figure 7: Representation of the CVA surface


Z Axis for Combined Value
Y Axis for Intangible Value
X Axis for Monetary Value

Accordingly an operational version of the IVM has been developed in which the procedures associated with intangible value (Stages 3, 4, 5) are taken over by an interactive computer aid in which the computer handles all the complex analysis and estimation within a strict framework that tracks back to logical rigour. Human perceptions on preferences and utilities are needed to 'tune' certain variable parameters in Stages 3 and 4 on setting up so that the embodied criterion reflects the value set as articulated by senior management; subsequent tunings are required only infrequently, say every six months, or when 'the world' has undergone a significant change. The 'tuning' is subject to very strict rules that match the demands of the interior logic of the analytical framework, and necessitates the presence of an expert facilitator and the attendant computer, but the tuning sessions are not prolonged. (Human participation is also required to provide utility scores for the intangible contributions that provide the inputs to the criterion in Stage 3.)

The computer generates simple visualizations of the value space in which value contributions are combined, as well as calculating all the results required to be on display for Stages 4 and 5. The visualizations have been found to be very effective in helping evaluators obtain an understanding of the implications of value combinations, whence acceptance of the validity of the method quickly follows. The critical combination occurs in Stage 4 when aggregate monetary value and aggregate intangible value are brought together for combination 'combined value' space. This is critical because it reflects the studied judgement of the importance of intangible value within the context of the organization and its objectives. An idea of what is involved in visualizing CVA space is given by Figure 7. It becomes simple at the second viewing!

1. A three dimensional space is required to provide the thinking environment for the combination of monetary and intangible value. Monetary value defines one axis (say the X axis), and intangible value defines another axis at right angles (Y axis). These two axes define the combined utility plane that underlies the figure. The combined value resulting from the combination is displayed vertically as combined value added CVA (the Z axis).

The result is a surface (or 'hillside') that extends over the plane with zero altitude at the no-good corner and maximum altitude (=1) at the ideal corner. Contours of equal altitude mark the contours of equal combined value.

2. Inputs from the subject, via stages 2 and 3, are fed to the utility plane and define the solution coordinate $u(m,i)$ for the subject. This is a location and has no value in itself.
3. A surface representing the combined value of every coordinate in the plane is erected above the plane. The altitude of the surface is the combined value of the underlying coordinate. This surface has been drawn for a type of combinatorial rule called 'regret' because regret is increased if (i) solutions do not have useful contributions of both monetary and intangible value, and (ii) the solution is a longer distance from the ideal point at the top of the surface. The resulting surface is bulgy (convex) as suggested by the shape of the two equal-value contours. (Other rules may be used; similar procedures are employed to set up the value combinations in Stage 3.)
4. The surface has also been drawn with more weight being given to money than intangible value. Unequal weights rotate the surface, so that here the altitude at the money corner is higher than that at the intangible corner.
5. Note that the flat money surface erected above the monetary axis represents the point of view of a decision-maker who only recognizes money and the utility of money.
6. The solution for this particular subject is shown as CVA(m,i). This is the point on the surface vertically above the coordinate.
7. Its value in a utility metric is found by projection onto the left hand vertical scale for CVA. This scale is linear. It is obvious that the intangible component in CVA is the increment ΔIVA and is the difference between (i) the actual combined value CVA(m,i) of the subject and (ii) CVA$(m,0)$ which is the CVA for the same input of monetary value but with the intangible contribution neglected.
8. The equivalent money value of CVA and the intangible component are found by projection onto the right hand scale for Quasi-money £CVA. This scale is slippery and very non-linear and is a function of the surface parameters and where the solution lies on the surface. Happily the computer-aid works it all out. The money equivalent of the intangible contribution is shown as £IVA, which is the difference between the computed money value of CVA and the actual money input £m, which is the same as £NPV from Stage 2.

By looking at the figure as if it were a hillside it is really quite easy to visualize combined value, and to read off the components of combined value. They are common sense. Only the money value £IVA of intangible value is awkwardly not amenable to mental arithmetic – the computer has to deal with it. Even so, trying out different inputs quickly shows that £IVA also follows common sense rules.

Next steps

Some form of information accounting must be brought on line and accepted by accountants and business managers if the holding of information assets and the products of information work are to given their proper importance. The previous brief look at the requirements for an information valuing system, with a particular implementation of an integrated value methodology, has shown that it really is feasible to deal with intangible value rigorously and to reflect it meaningfully back into a financial framework. It is not claimed that this is the only way of doing it, just that it is one way which both satisfies scholarly rigour and presents results which have been found to be valid and user-friendly when applied to real cases in the field.

The claim for rigour is important as it deals with the criticism that any 'measurement' of intangible (subjective) value must be 'soft', little better than a matter of opinion, and cannot really be put alongside 'hard' money accounting. The rigour incurs the cost of a little extra mental effort and computing, a price that will have to be paid if the criticism is to be countered. Indeed the price will be well worth paying as a respected form of information accounting will yield some distinct advantages both direct and political:

Direct advantages

1. Better understanding of the relationship between intangible and monetary value.
2. Reliable comparisons between the overall performance of alternative information assets.
3. Confidence in the quasi-objectivity of the results.
4. Better cost justification and investment decisions because the intangible contributions are brought within the compass of financial appraisal.

Political advantages

P1. Considerable credibility is brought to the valuation, which can no longer be dismissed as trivial or subjective.

P2. The increase in credibility will mean that the real value of information to an organization will be recognized, bringing with it changes in priorities and attitudes.

[redacted]

Accordingly an integrated and coordinating programme of work might be mounted by the profession of information management to develop and establish working methodology, build up experience and credibility, and define standards for measuring intangible value related to information and information assets. Such a programme will entail the allocation of effort by a proportion of researchers and practitioners, as well as cooperating host organizations. Collaboration with similar work undertaken in accountancy research would be essential.

Aslib could play an important role as it would step quite naturally into the role of professional coordinator. A first step would be the creation of a Special Interest Group focussed on information value and integrated methodology. This effort would merge usefully with similar work undertaken in accountancy research.

Preferred solutions and methods will emerge and will eventually fuse into a standard procedure for an accounting framework that handles intangible values and assets with facility. Eventually standard professional practice will be established jointly, and the value of information will no longer be a problem.

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2. Notice that EVA also includes as 'value' payments for all non-value adding activities generating error, waste and consequent corrective measures.

3. A very short list of supporting texts is given in the References.

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New technology and publishing: six case studies in search of a theory

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Abstract

The paper reports the results of a small qualitative study of six widely different publishing operations in a Mid-West campus town. Participants were asked to describe their organisation, their own work, the role of technology and procedures for purchasing technology. The responses showed a marked lack of strategic planning for technology investment in all of the participating organisations, though there were differences across the group in other areas, notably participation in purchasing decisions and training. The authors identify seven salient themes which may be explored with a larger sample.

Introduction

How do those who publish view technology? What tasks are enhanced by software? How do relationships between employees develop when computers/software applications are introduced? Can the interaction between publisher/author and publisher/reader change when networks are used as the main channel of communication? What motivates publishers to invest in a specific tool? These are some of the questions which lie behind this paper, a report of six case studies of widely different publishing operations in the Mid-West of the United States.

Publisher A is a publisher of books and journals affiliated with a university, with an established track record, and highly ranked in its sector. Publisher B is linked to a successful and long established professional organization, and their product may be seen as a service to members of their society as much as a product. Publisher C is responsible for a business journal, which is attached to a university department. Publisher D produces computer support documentation across the campus. Publisher E produces text packages for teaching staff to use in specific courses, and Publisher F issues an undergraduate poetry magazine. A list of the tasks that define publishing in each of the participant organizations, and the technologies which are deployed in these tasks, is given in Figure 1.

Figure 1. Tasks and technologies

Letters correspond to the publishers in the text:
A = publisher of books and journals, associated with a major university B = educational organization journal C = business journal
D = producer of computer support documentation E = producer of text packages F = undergraduate poetry magazine

TASKS	Communicate with authors	Communicate with printer	Edit & layout docs	Move docs	Manage info	Collect money	Printing	Disseminate docs
TECHNOLOGIES								
Phone	all	all						
Fax machine	B,C	C	C	C				
PC-based DTP			A,C,D,F					
E-mail	F			D,F				
Scanner			B,F					
Word processor			A,B,C, D,F					
Financial system					C	A		
Copier								
Laser printer			A,F,D					
Linotype							C	
Xerox 5090							E	
LAN			C	C				
Other networks	F							D,F

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Method

The study was intended as exploratory, to find out what was currently in place, and to identify issues which might be examined systematically in a further project. Not every employee in each organization was interviewed; the group who were interviewed were defined by willingness on the part of the participant as much as position in the company, though some attempt was made to identify those whose responsibilities might include budgets for technology investment. Each case study was based on a loosely structured questionnaire, developed by the authors, which covered the following topics:

- what is the mission of your organization?
- what is the nature of your work: the tasks, the communication patterns, the sources?
- how does technology fit into these different areas?
- has technology altered the way you work?
- who makes the decisions on introducing technology?

The topics emerged from a review of the academic and trade literature, and the questions asked were intended to allow the authors to assess the relevance of dominant theoretical frameworks (Porter's value chain (Porter, 1985) for example, and diffusion theory (Mirvis et al., 1991) a point discussed more fully below.

Participants were interviewed in February and March 1994; interviews were recorded, and an analytic report was produced for each company. The reports were then analysed as a common set of source documents to identify salient issues, and to rank these for discussion in the final document. Some of this work, and subsequent group writing, was done in a collaborative work lab. (Pappas, 1993). The group identified salient topic areas (and some subsidiary issues), and these are discussed below.

Seven salient themes

1. Motivation for adopting technology seems to be influenced by environment not economics

For most of the organizations who participated in the study, profit is not a motivating factor in the adoption of technologies. Though the observations recorded by the team may reflect that fact, few of those interviewed were in control of budgets, and most of these publishing operations were hosted by a larger institution. Those interviewed defined their output in terms of product, though a service industry perspective might be just as valid: providing an academic forum for the exchange of information or ideas.

In Publisher C, for example, the decision to implement a full range of desk top publishing technology was certainly not primarily motivated by economic factors; the managing editor simply stated that he felt it was necessary to do so. To some extent, economic factors were implied, inasmuch as part of the decision to implement technology revolved around reducing errors and shortening the time frame for publishing the magazine. However, no economic evaluation/justification was ever done, and to date none had been conducted. The staff feel that the technology has made life easier, but cannot quantify this perception.

Publisher B noted that the organization has 'deep pockets', which puts no pressure on them in terms of economic constraints for technology purchases.

Competitive factors were certainly not considered by C. While it recognizes three competitors, C is not overly concerned with out-and-out competition against these publications. This is illustrated best by the fact that the managing editor had no idea what the circulation of the magazine was, nor seemed terribly interested in learning it. Similarly, Publisher B indicated that they have only one competitor, but since the majority of the subscribers are members of an honours society, they are not concerned with circulation or marketing.

Like the smaller institutions covered in the case studies, Publisher A showed little concern for marketing in the sense of sustained analysis of the competitive environment. Nor has A measured changes which might be attributed to technology, though several of those interviewed reported improved turnover time in the processing of manuscript, improved accuracy of text and so on. Making money was not directly mentioned by those interviewed. A, though, through their search for eminent academics – big names – to write for them, may reflect their commercial acumen.

Publisher D is a not a cost recovery service and those employed there perceive this as a problem. Though some employees would like to carry advertising and charge for subscriptions, management perceives the service as a 'public good': if their readers are consumers of computing, it is their responsibility to tell people *about* computing. Because those who work there are not aiming even at cost recovery they often find if they have a good idea for something it may not be developed because they can't afford it. Photographs, for example, in the past cost too much money. Today technology permits this, but special permission must be sought.

While it is often said that in business small companies find it easier than large ones to be entrepreneurs and respond to rapid changes in the market, the principle may not hold true for publishing where a great deal of effort is required to elicit and market products regardless of size. Only one of the participating firms escapes this observation: Publisher E, the producer of customized textbooks, who view publishing activities not so much as a separate business but as a complement to a textbook retailing operation. The main idea was to attract more business to the store: 'Once students came in to buy their course packets, we figured that they'd want to buy textbooks and school supplies here as well.'

In Publisher F's case, a major reason for putting the journal online seemed to be because the technology was there already. Without the support of the technological resources provided by a major state university, it is doubtful that the host organization would have the infrastructure necessary to give resources to a student literary journal. To F's staff, typical business issues such as budgeting, competition, marketing, and advertising are not currently important. F is a student-run operation that solicits no advertising and sells for negligible cost, $1 per issue. The electronic version will be available free over the Internet. Though occasional underground poetry magazines appear, they usually do not last longer than a semester, so they are not real competitors. As an online publication, however, F's product will compete with other literary magazines.

No plans are yet in place to advertise actively or market F's publication. Also, because of the structure of the online version, the staff does not plan to make it available through a distribution list. However, a link to the organization's WWW server has been placed, which should alert many more users to the fact that the journal exists.

2. Strategic planning appears to be less important in the participating companies than individual or organizational values

Though there is considerable literature on the benefits of linking systems development to business strategy, this was not referenced by any of the interviewees. In two organizations, investment in technology was closely linked to the personal enthusiasm of a key individual who acted as a champion.

At publishers B and C, there was no mention of how technology (current or future) will influence the organizations despite a plethora of academic models which might help those who plan for and manage technological introductions to the firm. B, which intends to enhance operations with more technology in a few months, had no overall strategy to guide their actions. In fact, a single person is charged with full responsibility for selecting and implementing the new technology (DTP). This is in line with the lack of economic concern over the role of technology in the publication: as there is no fiscal incentive to improve efficiency or enlarge markets, there is no reason to select tools which might realize such objectives. In this well endowed organization, the mere emergence of technology seemed adequate reason to adopt. B uses outside service providers (not linked electronically) to handle printing and distribution. Here the value system of B comes into play, inasmuch as they have noted that they intend to continue to utilize the services of these organizations, regardless of the economic consequences. B stated that they have such faith in these partnerships that they want to 'stick with them'.

Like other participants, Publisher A had introduced technology piecemeal to improve small parts of the production process, rather than improve their strategic position in an industrial sector. The organization as currently constructed has clearly defined administrative divisions, and the deployment of technology reflects this. It was not clear who had been responsible for the technologies that were in place.

E's investment in photocopying equipment may be seen as an opportunistic rather than a strategic investment, a response to a market niche which emerged in the wake of the Kinko case. Such an investment by a small operation is risky, as it precludes later investment in potentially strategic technology, like the newer and more expensive XeroxDocutech, which is the medium of production that Prentice Hall and McGraw Hill have adopted as a strategic lever for publishing on demand. Equipped to go from electronic input to paper or electronic output, E requires a paper original and produces only paper documents. Publisher E thus acts now almost as a vanity press, printing and binding materials on demand', but cannot move into full scale custom textbook production.

At D the Publications group became guinea-pigs for organizational explorations of word processing and printing technology. When the organization was first experimenting with LANs, the first thing they did was to connect the group to a printer, and that was the first LAN application.

In the absence of a strategic technology plan, often the impetus behind technological innovation may be found to be one primary technology advocate, or 'champion'. An important element in the introduction of F's product as an electronic journal was the hiring of a key staff person, in this case the systems administrator. Supported by departmental grants, the systems administrator oversees the technical aspect of production, and is primarily responsible for the implementation and maintenance of the deprtmental gopher and Web servers. He is uniquely qualified for this position, combining an English major with a background in journalism plus a stint as consultant with the campus computing services.

In the case of Publisher C, the strong personal drive of the managing editor, who felt that technology was important for his organization, was a key factor in investment. C's managing editor was also able to hire his own assistant, and it is plausible to argue that he hired someone with a shared perception of the need for DTP. And while the editor at C is happy with the existence of the full text of the journal on ABI Inform, the firm that prints, markets and distributes the product for them is concerned about this fact. They fear that subscriptions to libraries might suffer as a result of the availability of the journal in an electronic format. To date, the managing editor has had to convince his partner that availability through ABI will not have an impact on subscriptions, and that it is a gesture of goodwill to libraries.

The purchasing decision in D was also in the hands of one officer. The Senior Coordinator for technical documentation first facilitated the acquisition of a laser printer for the pubs group, and then focused on evaluating DTP software for the IBM platform. (The Macintosh was not considered a serious computer, and the staff already had PCs on their desks) She read articles, went to vendor demonstrations, evaluated all the prose and cons. 'I picked Ventura for whatever reasons. There wasn't a lot to pick from'.

When D implemented desktop publishing they assumed that 'we would all be involved in the production process.' They are now back to a traditional (i.e. differentiated by task) structure with two graphic artists and four writers. However, that specialist structure has evolved into one where the editor and artist-writer work more closely, on the same 'creative wavelength'. Previously the editor did words and the artist did the graphics and layout. Now they both do both tasks. The artist produces the editor's graphic ideas and does some editing. This new relationship coincided with a new office space arrangement. Offices are open concept partitions; doorways now open onto each other from a common corridor. Previously their offices were arranged back-to-back, doorways facing away from each other. Staff observe that previously they were always running around in circles to share ideas, feedback and information.

3. Organizations show differential internal rates of adoption

It appears from the literature that technological innovation frequently tends to happen piecemeal, with certain components of the publishing process adopting technologies earlier than others. Thus, the diffusion of technology throughout the entire organization may be inhibited by even a few late adopters, despite the willingness of others to embrace technology. The role of early or late adopter may be acted out by any player in the process: authors, editors, layout artists, graphic artists, printing services, and the readers. The six cases represent various levels and rates of adoption of technology; they indicate that when technology is not adopted throughout the organization, the organization is unable to maximize the benefits of that technology.

At C, technology has been adopted throughout the operation (from use of DTP to the Linotronic used at the printing plant), and they anticipate further innovations (electronic transmission of text to the printing plant, possibly accepting manuscripts via e-mail). Authors clearly have accepted technology inasmuch as nearly 90% submit manuscripts on disk. No attempt has been made to determine the willingness of those authors to use e-mail, and no authors have suggested this means of delivery. As for the readers, the managing editor feels that there is not yet a market for electronic delivery of information, a personal hunch based on his observation that no competitor has yet moved into this area.

At B, technology has been adopted only in terms of editing and clerical assistant's work during the manuscript review process. While authors may submit articles on disk, B does not encourage this practice. Very few contributors use other forms of technology, although one author does use the fax to submit manuscripts. E-mail is not possible at this time for B, as they do not have access to any providers of this service.

The managing editor at B felt there is no need for electronic delivery to subscribers at the moment. The organization has been approached by Bowker and two other organizations, however, with proposals to convert the journal to CD-ROM format. These proposals have been turned down. One justification for this decision is the results of a survey in which subscribers indicated that they had limited access to computers, and that they preferred print copy of the journal.

At E, the adoption of technology has been complete, inasmuch as the copy machine is the sole reason the organization is able to offer their versions of publications. In this case, technological adoption by authors or the 'readers' is moot at present. There is currently no technological alternative for accepting the input, nor for distributing it. It may be possible in future, however, that both the faculty who are organizing the course packages and the students who are buying them could do so using computer disks, for example.

Fragmentation in the adoption of technology at Publisher D was due to the manifest inefficiency of their attempts at a totally integrated electronic production process: their model lino couldn't process without error or fast enough and now they use an imaging service bureau and send lino pages direct to the printer. However, it should be noted that the diffusion of technological adoption throughout D and through the parent organization is reflected in the history of the various publications they have offered. Initially, the print only publications were targeted at the more technologically sophisticated user on campus. Over time, as a broader spectrum of users became increasingly computer literate, D began to offer a greater number of publications for the novice or middle range user, and made more and more publications available online to an growing audience able to access those publications.

At F, adoption of technology has (and continues to) clearly spread through the organization at varying rates. As observed above, a single person is responsible for the introduction and use of technology. The other personnel are less interested. While some submissions of poetry are received electronically, most continue to be submitted in paper form. The editor feels that a wider range of readers will have access to the journal due to the electronic publication medium, but he has no evidence of this readership. However, it may be argued that, technically at least, wider readership is possible as a result of the addition of electronic distribution of the journal.

4. Training is task, technology and personality dependent

One would perhaps expect that organizations implementing major changes in technology would provide extensive training programmes for staff. However, training proved to be a minor concern for the organizations studied. A primary reason is that staff experience and personalities are such that formal training does not seem to be required. In the cases where it is required, training is provided by outside sources, or tasks are learned on the job. Another possible reason, in at least one case, is that the high level of technology makes training somewhat unnecessary. Interestingly, in the operations which participated in the study, the level of training does not seem to vary with the size or complexity of organization.

Publisher C as an organization has no concerns about training. To a small extent, this may be a result of the personalities of the employees, who seem open and eager to embrace new technologies. In addition, the assistant editor came to the job with a number of personal computing skills, and it may be that this prior training positioned her to self train on the desktop publishing software at C. She indicated that she continues to rely upon self training.

Publisher B, on the other hand, has been quite deliberate in the investigation of and selection of training opportunities for the staff. They began with in-house training and investigated private training companies, and have since settled on a community college which delivers the materials, the trainers and the equipment to B's site in a van. However, the editors interviewed indicated for the most part that they learned by experimentation.

A offers training by 'outsiders' to its staff – in this case, staff members attend campus classes, which they find acceptable. One of the respondents suggested that authors also ought to be trained, which would standardize the quality of the material submitted to A.

As F is a one-person operation, technical training for staff is unnecessary. As with the print version of the journal, most student staff are primarily involved with the selection process. Not all staff are as enthusiastic about the new technology as the system administrator: 'There's only a couple of people on the staff who are into the idea of it being electronic. I think a lot of people look at it and say, "Gee, it's really not all that different" and don't really see the potential.'

D provides no training for staff. They are expected to learn on their own. If they want to go to conferences as learning experiences, they have to go under alternative guise than training: to develop a class to teach, or present a paper. The Publications group has been dependent all along on having a writer-artist-editor who was inquisitive and fearless enough to explore new technologies on his or her own. The 'management' has not seen technology in production as an important focus for the computing organization.

At E, the Xerox 5090 has the capacity to produce a softbound book from start to finish in a few minutes. The employee who usually operates the copiers said that she had needed no training and that 'it was all fairly straightforward.' The typesetter, whose job it is to create tables of contents and title pages, and to clean up the professors' originals, likewise reported no problems with her software, but she had already acquired considerable work experience before coming to E.

5. The technology described in the cases does not appear to have significantly changed the relationship between reader, writers, publishers

The case studies do not provide substantial evidence that the way in which the three major constituencies of readers, writers, and publishers interact is changing. Some of those who participated, however, were aware that a transformation might occur if the fullblown scenarios for electronic academic publishing predicted by, for example, Rawlins (Rawlins, 1993) occur.

To a small extent, technology has changed the relationship between the publisher and the authors as authors at C are asked to submit their manuscripts on disk. In addition, the fax machine is used more for communications between publisher and their authors at both C and B. Within both organizations, technology has changed the relationship between the employees only slightly. They still prefer face to face meetings, even on minor points. However, they do report that the ability to edit a manuscript on disk has made their work easier, and editors of both organizations in particular feel more confident in the quality of the editorial work as a result.

For the print version of F's product, authors are not called in at any point to explain their work or to consult with the reviewers. In fact, authors are completely out of F's production chain once they submit their work. With the electronic version, the review process will not be anonymous, since the staff has decided more author-editor interaction needs to take place. The existence of e-mail submissions makes this a more workable system. The systems administrator has now set up an electronic mail address that people can use to make submissions. So far, he has heard from five authors and has received around 20 poems.

For F, the audience for the print product encompasses students, faculty and staff on the campus; the systems administrator expects that the audience will increase dramatically with the electronic version. But apart from sheer numbers, the electronic version will also allow increased reader feedback. Indeed, electronic mail addresses have been implemented to enable interested readers to contact F's staff and submit work. Several comments about the anonymous poetry and chapbook sections have already been received. When the WWW service is fully implemented, a more formal reader comment function will be added using Mosaic.

Total electronic interaction across the production system is not a feature of A at present, though the editorial onus on authors has increased where they provide camera ready copy, which gives the authors of highly specialized texts more chance of being published as it cuts costs. And editorial board members contacted authors through e-mail which streamlined communication.

At D, the original publications consisted of articles on particular applications for technical users, the only users that existed at the time. In the past year, they have noticed a new direction developing, specialized audiences who would develop their own technical news organ.

6. Technology affects production quality more than content

In a number of cases (Publishers B and C, for example), participants reported that technology had reduced the number of editorial errors due to the absence of re-keying of manuscripts and better quality proofs, while maintaining and enhancing production speed. The editors did not speak in terms of enhanced content, but in terms of ease of task when editing. At F, technology seems to speed up the submission process and production time, and transferring the text from print to electronic format will not change the content itself. Instead, technology for this publisher has created increased options in terms of the best way to design the interface. The 'level of quality control' is still maintained through the review process, and is probably the case at A, B and C. While one speaker at A specified that editing was made easier and that turnaround was faster, another reported that the benefits were mixed, and that often the manuscripts were so poorly done that the editorial task, in fact, was significant. (It must be noted that not all publishers interviewed were actually involved with the 'content' of the publications).

At E, the customised textbook publisher, there is no perceived need for content editing, even of the professor's original material. Staff at E are generally unconcerned with quality or content, provided that input/output flow remains steady. They will also publish anything so long as its sale can be guaranteed. Since most of what they publish is derivative, E are not involved in conventional negotiations with authors. Unlike those for conventional publishing, the criteria for selection of manuscripts in custom publishing has shifted from quality or authority of content to certainty of the demand: E does no editing, and does not evaluate the merits of a work, only its ability to sell. The student's need to buy the book for his or her class is not greatly influenced by quality or price, and the professor receives royalties, sometimes up to 20%, for putting together these course anthologies from already existing texts.

At F and D, wide area search engines have improved both circulation and delivery time. Since gophers are more ubiquitous among Internet users, F will be implemented first on the gopher, then gradually developed as a World Wide Web publication accessible using Mosaic. According to the systems administrator, gophers are particularly good at hierarchical collections of information. As a transport protocol, however, the Web is superior to gopher. It works better because it allows more 'server side-stepping', or determining what information the client needs. Of course, developers have to worry about visual presentation of data more. AT D, five years ago they had to hold news for the monthly paper publication, but today the can afford to have a bimonthly paper publication because of a gopher implementation for fast news.

7. Technology may lead to improved enjoyment of workplace because of more varied responsibilities

Besides affecting the publications themselves, the introduction of new technologies appear to affect the publications' staff. Several of the interviews showed that formerly clerical workers now enjoy a more varied work routine because of new technology. This has enhanced both their enjoyment of day-to-day operations and their willingness to stay with the organization. At C, the managing editor strongly suggested that a talented assistant editor, who learned the full range of technology used in publishing the magazine on the job, would not have stayed in the position if the technology had not expanded her range of responsibilities. The assistant editor continues to express great enthusiasm for the job, primarily as a result of the interesting technology at her disposal. To some extent, it may be possible that the technology is partially responsible for the assistant editor's pending promotion to managing editor when the current managing editor resigns. This move will make the overall organization one person smaller, but everyone believes that the operation will not suffer.

One traditional fear of employees is that new technology will be so cost efficient that it will replace them. In the organizations studied, this did not seem to be the case. At Publisher B, only half a secretary's position was lost due to technology, but she was reassigned to another department in the parent organization. What seems to be increasingly true, especially from the case study of F, is the great willingness and ability of non-publishers to take advantage of the new technology to create and post their own publications. Staff, in this way, gain much more power in the production of a publication than they previously had. The more powerful the technology, the greater the power of users. 'The current environment provides easy entry into the forum or "marketplace" of electronic publications. Financial barriers for those already having access to computers and the network are nil. Desire and motivation are the primary requirements for editors, support staff, and contributors, and their efforts must be considered labors of love' (Jul, 1992).

Technology as a means of improving staff morale did not, however, seem to be a big issue for those interviewed at Publisher A. Perhaps this is largely a trend in smaller organizations. One interviewee did observe that routine jobs such as overseeing the process of printing the book and finding typos have disappeared; one commented on the possibility of a new post of 'electronic copy editor.'

Conclusions

Analysis of the six case studies has raised one major question (in addition to leading the group to address the salient issues covered in the previous sections): what is the nature of publishing? Is it a business which can be described in terms of defined criteria, the work of an intermediary who takes financial risks on behalf of a producer and handles distribution and marketing; or is it merely a communication process which involves one to many or many to many? (Kaufer and Carley, 1993).

Does Publisher C, for example, still merit the label now that a recent arrangement with another company has left the printing, marketing and delivery of the magazine in the hands of that other company? What role does this leave for C's personnel? Is the intellectual process of selecting, editing and laying out manuscripts a sufficient criterion to call what is left of C a publisher? And what about Publisher E, a derivative rather than a primary publisher? In the case of a 'publisher' primarily defined in terms of communication (the re-packaging service offered by E) such criteria may not apply. Instead of applying the traditional models of publishing to Publisher E, it is as important to ask first whether we want to consider them a publisher, since they do no editing, make no judgments about the worthiness or content of the materials they produce, seek to print materials which are not authored by the person with whom they negotiate, and print materials which have no value outside of a highly prescribed setting. E, in fact, functions more as a printer than a publisher, offering a service as opposed to offering a unique product.

Publisher F raises the question of whether, in the context of a publication serving the parent institution, the very definition of the terms 'publisher,' 'publication,' and 'journal' can change? Can F's product, for example, serving the goals of the department, be termed an electronic publication? Most definitions of electronic publishing concentrate on either the utilization of electronic desktop layout technology for a printed work or electronic dissemination of a document that is never produced as a print product. Current definitions of what is and is not an actual electronic journal abound. As a form of electronic communication, electronic journals are often defined in terms that seem somewhat anachronistic: issues appear at generally predictable intervals, issues are numbered and dated, and the materials contained in the journal are subject to some form of editorial control. According to Langscheid, a true electronic journal is 'one that exists in electronic format only, rather than a "parallel" version of a print journal' (Langsheid, 1991).

The medium is beginning to change the presentation of the journal's message. This is especially true in F's case, as they are abandoning the linear magazine form for the anonymous poetry, chapbook, and archival sections. In the coming years, the arrangement of information in electronic publications will become as significant an issue as the content of the publication. How they look, and thus how readers use them, will be as important as what they say. As Jul states, 'the continued development of display technologies and user interfaces certainly will affect how widely accepted electronic journals become' (Jul, 1992). Added to this new flexibility is the growing use of hypermedia or (as Nelson defines it) non-linear text, presented on an interactive computer screen, that allows the reader to sequence the reading of material as he or she chooses (Nelson, 1987). Now, however, text can be linked with still graphics, audio clips, video, and a whole host of other resources. The proliferation of electronic information systems such as World Wide Web is empowering small publishing operations to take advantage of these hypermedia resources at a very low cost, with very high reward.

Technology has perhaps blurred traditional boundaries by eliminating the author (as texts such as this group-written one can evolve through a process of dynamic interactive process facilitated by technology; or as readers design their own texts from a text database), the editor, and/or the printer.

What is the role of formal models?

The team read extensively in two literature sets which discuss the impact of technology on organizations, the literature on the diffusion of innovations, and the literature on value associated with Michael Porter. Though parts of what was observed in the case studies could be fitted to these theoretical frameworks, none of the organizations could be used as an exemplar per se. The changes which were observed across all of the case participants were bottom-up rather than top-down effects of investment in technology.

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The knowledge base of social work: a citation analysis

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Abstract
The knowledge base of the social work profession was studied. Previous research has generally taken into account only citations from social work journals. In this paper a broader view was taken. Consequently in order to determine the sources of knowledge in American and non-American journals, citations from four sources for the year 1992 were counted and analysed: social work journals, journals from other fields, books and grey literature. The most frequent citation source was books, followed by non-social work journals, grey documentation and finally by social work journals. Differential use of the four sources by American and British journals was noted and discussed in terms of structural and ideological restraints extant in the two countries.

Journals are said to play a fundamental role in the development of all disciplines and professions. The disseminate knowledge written by contemporary scholars and aid in the continuing development of a profession's knowledge base. Cheung (1990) asserted that academic journals are vital for information dissemination and knowledge exchange. Grinnell and Royer (1983) found that they serve as a primary means for disseminating theory and research findings. Kirk and Corcoran (1989) noted both the cumulative aspect of knowledge development in journals and the minimization of duplication. Baker (1992) in his analysis of the journal network structure found that journals impact on the advancement of knowledge within a field or profession. Journals also create a record of how well professions meet the basic requirement of possessing a unique body of knowledge, disseminate information and facilitate the development of a cumulative knowledge base for the profession (Lindsey and Kirk, 1992). Scholarly journals are therefore seen as a means of facilitating the growth and development of scientifically-based knowledge. Finally, by being published, journals preserve the knowledge base in archival form (Lindsey and Kirk, 1992).

Social work, as other professions, transfers knowledge via scholarly publications which appear in journals.

Epstein (1990) viewed social work's refereed journals as a dominant source within which the field articulates its experiences. Kirk (1991) offered two other roles that the peer-reviewed journal serves in social work. The first is in the academic realm: the journal is the established forum by which methods of

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fulfilling those demands placed on the profession to develop and amass a credible applied knowledge base which can subsequently be transmitted to university scholars, practitioners, students and others who address the problems confronting society.

The origins of social work knowledge are fundamentally two: field agencies and academia. While practical social work experience is manifest mainly in field agencies, the primary generator of social work knowledge, namely research published in social work journals, springs for the most part from academia Grinnel and Royer (1983) reported a disproportionate number of academicians authoring articles. Reid (1987) found that almost 80% of all research articles abstracted in the journal *Social Work Research and Abstracts* between 1980 and 1982 were produced in academic institutions. In a recent survey of authors (NASW, 1993) whose work appeared in the 1992 issues of the journal *Social Work* it was reported that 63% were academics and only 24% were practitioners. Kirk and Corcoran (1989) explain this situation by proposing that academicians have an interest and aptitude for knowledge development. Academicians are seen as the trustees of the profession's knowledge base which is then shared with others within and out of the profession via journal publications (Lindsey and Kirk, 1992). Another reason is that academicians are required to publish while practitioners are required to practice. Practitioners have not gained the skills necessary to publish (Kirk, 1991).

The social work knowledge base

Lindsey and Kirk (1992) studied the citations

Table 1. Type of citations by country

	Country				Total	
	United States		United Kingdom			
Type of citation	N	%	N	%	N	%
SOCIAL WORK JOURNALS (Baker)	773 (451)	19.7 (58.3)	90 (21)	7.4 (23.3)	863 (472)	16.8 (54.7)
OTHER JOURNALS	1,1176	30.0	339	28.0	1,515	29.5
BOOKS	1,279	32.6	483	39.9	1,762	34.4
GREY DOCUMENTS	690	17.7	299	24.7	989	19.3
TOTAL	3,918	100.0	1,211	100.0	5,129	100.0

increased their contribution to the knowledge base over the years. They concluded that the profession is served by several core journals which have consistently increased their contribution to the knowledge base over the years. They unfortunately did not provide a definitive list of their core journals but instead allowed the author to peruse the reported data and arrive at his own conclusions. Baker (1992) in a citation analysis of 20 social work journals identified what he also termed core journals of the social work profession. The core journals were those which were most cited by others and which also cited each other most frequently. The five core journals are: *Social Work, Journal of Education for Social Work, Social Casework (Families in Society), Social Service Review* and *Social Work Research and Abstracts.* Baker concluded that these journals form the basis of a social work journal network. The citation analysis also revealed sub-networks. Baker suggested adding the *Journal of Social Service Research* to the core journal network as suggested by Thyer and Bentley (1986). A child welfare group of core journals also emerged with *Child Welfare* in the centre.

In his journal-to-journal citation matrix Baker (1992) traced the transfer of knowledge from one journal to another. In a reanalysis of Baker's data we found that fourteen of the 20 (70%) journals cited themselves more frequently than any other journal. The six remaining journals in the study cited the journal *Social Work* most frequently. Of the 3,706 citations that appeared in Baker's bibliographic analysis, 1,777 citations or 47.9% were self-citations. This is an indication that each social work journal tends to 'talk to itself' rather than to import knowledge from *other* social work journals. Finally, 52.1% of the citations were drawn from other social work journals and journals from outside the profession. This conforms to the position (Goldstein, 1990; Cheung, 1990) that social work concerns itself with a wide band of human behaviour and draws upon the knowledge and experience of related professions. This will be elaborated below.

The international, i.e. non-American, titles *(British Journal of Social Work, Journal of Social Policy, Indian Journal of Social Work)* included in Baker's study (1992) were tied marginally into the journal network. Most of the linkages were unidirectional, namely international journals cited American titles. The only exception was the citation of the *British Journal of Social Work* by American journals. Baker suggests that the reason for the scarcity of international citations by American journals is that very few international social welfare titles were included in the majority of online bibliographic databases available to American scholars.

Goldstein (1990) and Cheung (1990) warn us not to restrict the social work knowledge base exclusively to social work journals. Early in its development the social work profession lacked its own knowledge base; hence it was required to borrow from the social sciences in order to initialize its own empirical and practical knowledge base (Goldstein, 1990). It was found that the knowledge source from which social work writers drew upon was by people in fields such as psychiatry, psychology, sociology and social anthropology (Stretch, 1967; Grinnell and Royer, 1983; Karger, 1983; Weick, 1987; Cheung, 1990; Fraser *et al.*, 1991).

Many voices are heard within the profession concerning the epistemology of social work knowledge. One categorization of the positions concerns the impact and applicability of empirical findings. On the one hand there are those who continue to carry out or demand experimental (or at least quasi-experimental) research. Others call not only for a broadening of the experimental laboratory to encompass field practice, but also the inclusion of practical field experience (e.g. case descriptions). The first approach, because its outcomes widely appear in research journals (Raskin and Bernstein, 1987, and Bergmark and Oscarsson, 1992) is claimed to be less relevant and useful to social work practice. This may be because research journals are seen as basically conservative.

Berman (1994) identified a large source of social work knowledge, namely, grey documentation. The contents of the documents in a grey document database include, for example, information prepared for policy analysis, strategic planning, short term planning, decision making, evaluation, needs assessment, management information and reporting. Because of its distinctive characteristics this literature does not usually appear in published form in professional journals. Rather, it remains at the periphery of the knowledge base. The persons for whom these documents were prepared include elected officials, policy-makers, planners, administrators, experts, scientists, field workers, practitioners, clients, voluntary associations, lay persons, the general public, and the media. Grey documentation which by and large emerges from the field rather than academia provides an additional knowledge source which is more useful for practitioners than academic scholars. Finally grey documentation may be able to play a role in providing practice based knowledge for scholars in their goal of creating an applied knowledge base for the profession.

The ubiquitous book is an additional source of social work knowledge. Strangely it has escaped the scholarly attention of those seeking to understand the structure and content of the social work knowledge base. The number of social work books appearing in *Books in Print* between 1973 and 1988 grew dramatically. Baker (1990) reported that there has been a virtual explosion in book publication within the profession from 82,000 books in print in 1973 to 180,000 books in 1988. Machlup (1980) informed us that scientometricians believe that all primary research findings in the 'hard sciences' were reported in journals and that books therefore were irrelevant as a measure of scientific knowledge. Machlup claims that this conclusion is untenable regarding recording knowledge in the social sciences and that in this area books are of consequence. Fraser *et al* (1991) summarized the issue of the knowledge base by stating that 'the evidence suggests that no single way of knowing dominates the profession' (p.13). The encouragement to draw upon alternative sources of knowledge in social work also receives ideological support from such writers as Imre (1984), Weick (1987), Berlin (1990), and Goldstein (1990). These writers call for an expansion of knowledge-building to include sources of knowledge other than empirical sources. Imre (1984) wrote: 'In order to help other human beings, the knowledge social workers need spans the breadth of human knowledge contained in all available sources, including those of the sciences and the humanities' (p.44). Peile (1988) suggested the value of a critical paradigm by which knowledge develops through a dialectical process. In our context the dialectical process is the synthesis of four different sources of knowledge as manifest through the use of citations each with its unique characteristics and contribution to accumulating knowledge.

Given the above analysis, four knowledge sources have been identified which serve as the citation pool for articles in social work journals. The sources are social work journals, journals from other fields, grey documentation and books.

It is the purpose of this study to determine the extent of differential use of the four sources of social work knowledge. Usage data have direct implication regarding the source of the social work knowledge base. Can it indeed be asserted that social work has an independent knowledge base? An extension of both the citation analysis in which Baker (1992) identified five social work core journals and the analysis of the present authors in the introduction above concerning the journal 'talk to itself' syndrome, United States, United Kingdom bilateral knowledge sharing is analysed.

Methodology

The methodology included three steps.

Step 1: For purposes of the study, five social work journals were identified as the citation pool source. These were chosen from among the 23 core journals cited in the journal *Social Work Research and Abstracts* (1992). These five included: *Journal of Social Service Research, Social Work, Child Welfare, British Journal of Social Work* and the *Journal of Social Work Practice.*

The *Journal of Social Service Research* was chosen as an example of a central social work research journal. *Social Work*, a generic journal, was the most frequently cited core journal in Baker's (1992) analysis. *Child Welfare*, a specialist journal, was considered by Jayaratne (1979) as a core journal. Tripodi (1984) included it in his study of research publication in social work journals. In Baker's study *Child Welfare* was the most cited extra-core journal. It was also the most frequently cited specialized journal. For the sake of balance, two non-American core journals were included: the *British Journal of Social Work*, a generic journal, and the *Journal of Social Work Practice* a specialized English journal. These are the only British journals cited in *Social Work Research and Abstracts.*

Step 2: The citations appearing in each published paper for each of the five journals were grouped and counted according to the four citation categories. In the first category citations from social work journals based on the list of core journals found in the journal *Social Work Research and Abstracts* were counted. The second category of citations was 'other journals', namely, all journals not defined as social work journals. The remaining two categories were grey documentation and books.

Step 3: In order to measure the level of bilaterality of knowledge sharing between the United States and the United Kingdom journals, several frequency counts were made: 1. the number of citations made to Baker's five core journals (all American) by the three American and separately by the two British journals; 2. the number of citations made by the two UK journals to other UK journals and to USA journals; 3. the number of citations made by the three USA journals to other USA journals and the UK journals.

The raw data consisted of the number of citations counted within each relevant category. The analysis included all articles appearing in the five journals during the year 1992.

Results

A total of 5,129 citations were recorded from the five social work journals for the year 1992. The most frequent citation category was books, 34.3%, followed by citations from non-social work journals, 29.6%. Grey documentation accounted for 19.3% of all citations. Social work journals contributed 16.8% of the total (see Table 1).

Baker's (1992) core journals play a more dominant role in the American than the British social journals (See Table 1). 58.3% of all citations from the social work journals are from Baker's core journals. In both the journal *Social Work* and the *Journal of Social Service Research* over fifty percent of all social work citations are from the five core journals. 33.1% of all social work citations on the journal of *Child Welfare* are from Baker's core journals. In the two British journals only 23.3% of all citations from social work journals are from Baker's core journals.

Discussion

The results indicate that less than 20% of the citations stemmed from social work journals. Consequently it must be asked why previous citation analyses of the social work literature relied only upon journals as the citation pool for study. This may partially be explained as resulting from professional selective perception consequent to academics regarding refereed journal articles as the major conduit to professional recognition.

An additional position explaining the reliance on journals as the sole source of the citation pool is expressed by Karger (1983). Karger defined the academic journal as the source of the social work profession's knowledge base in terms of power. He states that teaching of research in schools of social work is designed not only to create informed consumers, but is also designed to develop a constituency of social workers who accept and identify with the scientific paradigm. Karger continues that reinforcing the empirical method in social work gives researchers 'the power to define the reality of the profession' (p.203). This leads not only to defining the boundaries of the professional knowledge base, but it also thereby establishes the practice method of the profession as being empirically-based (Blythe, 1992). It also sets the tempo of the profession as science tends to support and preserve the status quo (Raskin and Bernstein, 1987).

We found that the British journals very infrequently (7.4%) cited those 23 journals identified by the journal *Social Work Research and Abstracts*. We did not find support for Baker's (1992) finding that British social work journals cite American journal titles. Specifically we found that only 1.7% of all citations in our sample of British social work journals are from Baker's social work core journals, which are all American. 11.5% of all citations in the American social work journals are drawn from Baker's social work core journals. The reason for this lack of communication between British and American journals may be an ideological one (Peile, 1988) or it may be the result of a greater use of grey documentation within the British social work community which relates to British social work knowledge needs. These findings indicate differential use of social work journals between American and British social work journal writers. It also questions Baker's thesis that the five journals identified in his study represent the core of the social work knowledge base. It seems more to be the case that they represent core journals of American social work.

It is worth to noting the greater use of grey documentation by the British than the American social work journals. One may explain this as a structural phenomenon arising out of the closer relationship between grey documentation production and the university system in the United Kingdom than in the United States. 96% of all United Kingdom Department of Health research funding relevant to the personal social services was allocated to academic centres (Statham, 1992). It may be only at a later stage in the research's history that it is published in a journal or as a book. In a report (Administration for Children and Families, 1994) to the Office of Management and Budget, the Administration for Children and Families of the Department of Health and Human Services (DHHS) in the United States, the data revealed that only 41% of all research and development was carried out by colleges and universities, 34% was carried out by private industry, 24% by non-profit organizations. 1% of all research and development was carried out in-house. Studies published outside of the university network do not necessarily enter into the social work knowledge base. This might be for the technical reason that they are not included in the majority of online bibliographic databases or alternatively for the ideological position that it is the academic journal that produces the knowledge worthy for the profession.

Implications and conclusions

A combination of ideological and structural restraints may preclude more varied use of knowledge sources in social work. On the ideological level the conventional twofold premise is first that the journal is the bastion of a profession's knowledge and second that the social work profession should have its own unique knowledge base. This conception of knowledge in social work represents a debate between the empiricists and the practitioners concerning who controls the relevant knowledge base of the profession. Our study indicates that social work as a mature profession does not demand a unique, inward searching knowledge base. Instead it seeks an integration of knowledge not only from social work but also from a plethora of other behavioural professions. This was noted by Cheung (1990): 'Social work has used an interdisciplinary approach in some major work areas such as practice, research, education, treatment and administration. Social work has based its knowledge on other disciplines, enabling the application of information with supporting evidence that ensures the validity of its knowledge and builds firmly from its own base and framework' (p.28).

Those who advocate the search for a broader knowledge base in social work beyond the journal article and the grey document need not seek further than the book. Unlike published papers which must obtain editorial approval, the book represents a broader, freer platform for expressing novel or less conventional ideas. The function of the book in social work knowledge remains to a great extent a mystery. While the social work journal has been closely scrutinized (Weinberger and Tripodi, 1969; Jayaratne, 1979; McNeece, 1981; Grinnell and Royer, 1983; Tripodi, 1984; Thyer and Bentley, 1986; Cheung, 1990; Fraser *et al.*, 1991; Baker, 1992) the social work book has not. How and what the book contributes to social work knowledge is thus fertile ground for research. It may be that more equitable and novel use of social work knowledge is found in this ancient form of communication.

The data seem to indicate that governmental priorities in research funding may be a factor in suppressing use of grey documentation as a social work knowledge source in the United States. The lack of academic legitimacy accorded to grey documentation may prevent social work academics from fully exploiting this knowledge source. Four solutions present themselves. The first, as suggested above, is that the social work school play a more dominant role in carrying out government research. The second is the wide-scale inclusion of grey literature either in existing or new online databases. The third may be to apply more rigid standards to the publication of grey documentation. This was suggested in a study carried out by the President's Science Advisory Committee (1963). The study, known as the 'Weinberg Report', concluded that 'technical reports should be refereed or otherwise screened before they enter the internal information system.' This proposal is an attempt to admit grey documentation into recognized, legitimate channels of knowledge. These authors doubt the value of this suggestion. Firstly by applying 'more rigid standards' this category of literature may become less grey and more akin to its academic cousin. Secondly, it would be difficult in the extreme to convince the far flung generators of grey literature to abide by the new standards. And for those who do not, would a new category of grey literature consequently appear? Finally such an approach would rob grey literature of its inherent uniqueness thus creating a more sombre learning experience. The fourth solution is that the social work knowledge base may be expanded by restructuring the social work knowledge dissemination through the recognition of the contribution of additional knowledge producing organizations in addition to the academic university setting (Berman, 1994). This might include the professional school (Mac Rae, 1987), the non-university research institute (Rose, 1976) and the 'problem solving community' (Mathisen, 1990). Whichever, if any, solution may be adopted, it is clear that non-journal sources are widely and freely used in the social work knowledge generation process. This should be further encouraged and facilitated.

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Quality in learning support services

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One of the recommendations of Follett that looks very likely to be taken up quickly is that relating to including the Library Services in the Quality Audits. This may well spread to include all the central learning support services so it is an issue that will affect not only libraries but other similar services. The assessment of FE colleges already incorporates such an inspection and so regional colleges are undergoing this process presently.

Audit is about checking the documentary evidence for assuring quality, checking that it is known, understood and acted upon and recorded. It means that it is not good enough for heads to 'know' the facts. They have to be recorded, passed on, discussed, cases made , etc. It is not a BS 5750 process where you can set the lowest level achievable but is a look across the real system, so we need to be with the best not the worst!

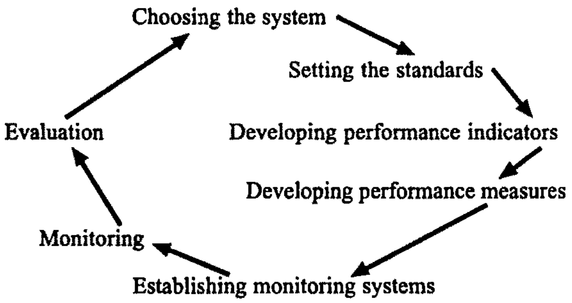
What might we look for in a quality audit?

1. Quality starts at the institutional level

Staff in the service departments should have a clear awareness of the institutional mission statement, corporate plan and strategic plan. The services should clearly be able to show how they fit into this plan and how they derive their quality assurance measures from it and support it. The interaction needs to be two way: not only are the services aware of the institutional context but the institutional plan takes into itself the services plan.

Four factors need to be in place at the centre if each part of the organization is to deliver quality:

1.1 a focus on human resources and staff development
1.2 a review process for the delivery of an information service
1.3 a feedback system
1.4 an integrating, broad view of reviewing service delivery and information systems, with the assistance of a quality development specialist


Choosing the system
Setting the standards
Developing performance indicators
Developing performance measures
Establishing monitoring systems
Monitoring
Evaluation

Elements in choosing the system could include:

Improving user experience
  development of charters, codes of practice
  statements of user entitlement
  feedback from users on the service
  setting up complaints procedure

Accountability to users and others
  reliable data for funders
  defined target groups
  services delivered and outcomes defined
  demonstration of cost-effectiveness

Improved market share
  descriptions of service quality levels
  identification of new services
  prioritization of resources

2. Quality at the service level

Each service to have and use its own mission statement that is firmly based upon the institutional mission. There must be clearly thought out aims and objectives and a strategy for achieving these within given and agreed timescales. Our staff should be made familiar with quality terminology so that they can show they are familiar with the concepts of quality assessment and delivery. Every member of staff is part of a quality service and should have enough information to see how their work contributes to the success of the whole.

Quality can be said to come from four elements. Firstly there is the description of the process that provides the basis for all that follows.

Secondly there is the management structure both for the service and the way the service is allowed to interface with the larger university. Is the structure appropriate to deliver the agreed objectives or indeed to assess what those objectives should be?

Thirdly, there is the quality of staff and materials. Good quality staff can often cover for less than generous financial allocations for materials! However, examples of stock sitting on the shelves for over a year without being used could be considered as an indicator that quality selection was not being employed. This may not be the fault of the service department but indicate lack of understanding between teaching departments and service departments. (A figure of 20% of library stock falling into the not used within 12 months of purchase was the last research I saw from academic libraries – but that was several years ago.)

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Fourthly, there is the resource allocation that allows the service departments to deliver quality. It must be closely tuned to the needs of students and staff so that reasonable quantities of materials can be supplied. Often we can provoke expectations and then not meet them; this gives the users the feeling that quality is missing.

We must recognize that some aspects of quality are very hard to measure reliably and that quality means different things to different people. There will always be a tension between being client-centred and the pressures applied from the funders of the service.

3. Performance indicators/measures are important

Performance indicators show progress to achieving the actual performance measure (targets) for the period under review. For example, monthly budget statement are an 'indicator', the actual end of year statement is the 'measure' of your success in living within agreed allocations (targets). *Neither necessarily measures 'quality'!!!* The quality comes from the appropriateness of the spending to achieve the intended objectives.

There should be both input and output measures. Measures should be able to compare:

3.1 Over time
3.2 Against comparable but selected groups of services
3.3 Against national standards
3.4 Against national averages

Items 3.3 and 3.4 are more problematic since they can distort the actual mission of the individual university. Are national standards or averages set at levels that produce quality for you?

4. The measures will need to be tuned to our regional mission and be derived from that mission and its delivery

However, there are some general measures that we can easily list that can be used across the sector as well as being hospitable to our mission statement:

4.1 Bodies through the doors
4.2 Number of students in the university
4.3 Student membership of the services where, like libraries, this is appropriate
4.4 Staff in membership of a service
4.5 Opening hours and their spread over the week
4.6 Loans, enquiries, searches, etc.
4.7 Reservations and inter library loans, equipment loans, etc.
4.8 User education programmes and their take up/effect
4.9 Seat occupancy/space utilization
4.10 User surveys and their use in modifying services and documentation
4.11 User appreciation of service and its importance to them

5. Resources measures

5.1 Size of stock, additions, withdrawals
5.2 Range of equipment to support learning and its appropriateness
5.3 Book stock per person (staff and students)
5.4 % of budget spent on particular classes of service (books/periodicals/staff/hardware/software/etc.)
5.5 Revenue expenditure (total and per FTE)
5.6 Detailed budget breakdown and justification for each part
5.7 Capital allocations, what used for, justification
5.8 For each service a breakdown of expenditure on specific services, e.g., IT, Special collections, new titles, improving stock quality, network reliability, etc.
5.9 Amount spent on supporting specific areas of work/subjects

6. The physical resources from which the services are offered:

6.1 Number of sites
6.2 Total area available for the service
6.3 Area per FTE
6.4 Study places/work places per FTE
6.5 Appropriateness of space to use (quality issue!)

From these ranges we should be able to correlate costs per FTE, seats per FTE, SSRs of various kinds, stock per FTE, etc.

At present I believe we can answer most of these questions at a senior level. We do have aims and objectives for the services based upon the institutional mission, we do undertake surveys of users, we do keep detailed budget, space, capital figures and can describe their use. We do have many records showing user volumes. The users surveys that we all conduct are about quality rather than performance measures alone. However, the volume of returns that we get make reliance upon those survey-alone dangerous. We will need to seek ways to 'beef' up the replies.

We are weak, I suspect, in that staff at all levels may find it difficult to answer questions if approached directly and I am not sure that we share all the planning information down to the 'sharp' end of our services. We may be guilty of thinking that there is not enough time or that they could not understand the process. Perhaps this is an area we need to debate?

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University libraries in Ghana: some observations

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Abstract

This paper examines the current state of affairs in Ghana's three oldest university libraries. Based on observations and some research conducted, the article discusses a number of issues like stock, facilities and services available, administration and staffing. Other issues include hours of opening, funding and library accommodation/ infrastructure. Problems (notably among them, finance) hindering the development and progress of these libraries have also been identified and discussed. Finally, recommendations on how the existing poor situation can be improved, which include the need for adequate funding, establishment of an academic library association and resource sharing, are offered.

Introduction

Currently, Ghana has five universities (Table 1). The first two were established under British colonial rule, while the remaining ones were founded after independence (6th March, 1957).

Information about them – names, locations, years in which they were founded, levels of programmes offered and years in which each obtained full university status have been provided.

This paper, however, restricts itself to the three oldest university libraries, namely University of Ghana (Balme Library, UG), University of Science and Technology (UST) and University of Cape Coast (UCC). The main reason for this coverage is that the last two universities – University for Development Studies (UDS, Tamale) and University College of Education (UC, Winneba) are in their initial stages of development, and for that reason, their libraries too are in their formative years.

University libraries in Ghana

University libraries constitute a distinct group in the general provision of library services in Ghana. They are organized and administered along lines which are comparable with those adopted or prevailing in the British university library system. Over the years, they have fulfilled their prime function – provision of adequate resources and services to meet the stated purposes, goals and objectives of the institution of which they are part. In recent times, they have 'acquired' another duty, opening their doors to the local community, members of other institutions of higher learning, professionals, researchers from state and para-statal organizations and private citizens. Alemna observes that, 'members outside the university who would normally use school, special or public libraries have turned to the University library for help for obvious reasons'[1].

The stocks

University libraries in Ghana started building their collections with initial stocks transferred from the then Achimota College library at various times. With the aid of academic departments, they have acquired library materials, namely books, journals, pamphlets, maps and atlases. Other relevant items, including

Table 1. Particulars of universities in Ghana

	Institution/ location	Year founded	Levels of programmes offered	Year obtained University status
1	University of Ghana (UG), Legon, Accra	1948	Diploma, Bachelor's, Masters, Ph.D	1961
2	University of Science and Technology (UST), Kumasi	1951	Diploma, Bachelor's, Masters, Ph.D	1961
3	University of Cape Coast (UCC), Cape Coast	1962	Diploma, Bachelor's, Masters, Ph.D	1971
4	University for Development Studies (UDS), Tamale	1992	Bachelor's only	1992
5	*University College of Education (UCEW), Winneba	1992	Diploma, 2-yr post-Diploma, Bachelor's only	–

* Comprises five out of the seven former diploma-awarding colleges, namely Advanced Teacher Training College, National Academy of Music, Specialist Training College (all located at Winneba); College of Special Education (Akuapem-Mampong) and School of Ghana Languages (Ajumako) which have been transferred to Winneba.

Again, this institution has been placed in a 'special relationship' with the University of Cape Coast.

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microfilms, tapes, slides and audio-visuals, which students are expected to consult in course of their studies or in the preparation of theses, dissertations and project works, have been acquired. Rare or special collections relating to the history and prominent peoples of the Gold Coast (Ghana) (e.g. Mr J T Furley, Secretary for Native Affairs in the Gold Coast, 1917-1923) are also kept. Access to these materials is restricted and allowed under strict supervision. These book and non-book materials have been acquired often through donations, gifts and exchanges or purchases. Under the Book and Newspaper Registration Act of Ghana (Act 73,1961) and its Amendment Act (Act 193,1963), these libraries are expected to receive, free of charge, copies of everything published in Ghana and about Ghana, except government publications.

Their status as depository libraries also enables them to receive materials and publications from the United Nations and its specialized agencies e.g. FAO and UNESCO.

Collection building is undertaken in these libraries bearing in mind the levels of degree programmes offered, the various disciplines that are taught or the aims of the particular University. Thus, the stock of UCC library has a strong predominance of books on education, since its university trains graduate teachers for Ghana's second cycle institutions.

Pitcher, a former UST librarian confirms that:

> 'although the university library attempts to cover every field of knowledge, emphasis is put on the special disciplines taught in the university... The library is particularly strong in the pure, applied and engineering sciences and allied subjects. The Humanities are fairly represented but do not measure up to the strength of the science subjects)'.[2]

This bias has led to a wide disparity in the volume of books and serials as well as the rate of annual growth of library materials in the universities.

Indeed, their rate of growth is insignificant, taking into consideration the global book production in all fields of study – what is known as the 'information explosion' of recent years. These libraries are much smaller in resources when compared with others in the developed countries. The total stock of the Balme library (UG) is over 350,000 volumes. UST and UCC libraries stock about 250,000 and 200,000 volumes respectively as at September, 1993.[3]

The reasons for these small collections are: insufficient funds to purchase the needed materials; exorbitant increase in subscription rates of periodicals; foreign exchange restrictions; non-enforcement of the legal deposit laws; cumbersome and wasteful acquisitions procedures and the general low output of the publishing industry in Ghana. In fact, the country's young publishing industry remains crippled by the high cost of paper, ink, printing machines and photographic plates. When existing machines break down, they cannot be repaired for lack of spare parts. The effect of this on university libraries is obvious: *The Ghana national Bibliography* is very irregular, leading to fragmentation of literature and literature/information famine in the country.

Another characteristic of these libraries is that some of their holdings are outdated and are of little or no research value to users. Kisiedu, University Librarian (UG) confirms this, '...in the Balme library, there is a massive weeding operation to remove outdated books to make way for new ones'.[4]

Services to library users

University libraries in Ghana provide facilities and services which are designed to promote and facilitate effective use of recorded information in all formats by users. Apart from provision of the traditional library services such as lending, reading/study, reference and information, inter-library loans, they also provide current awareness and selective dissemination of information. They maintain reserved collections, consisting of multiple copies of undergraduate readings as well as research materials for graduate students.

Terms of loan, general regulations, circulation procedures and access to the libraries' collections have been spelt out in the various library guides and other library publications like the staff manuals.

They possess a good collection of equipment (though not sufficient) such as photocopying machines, microfilm and microfiche readers, computer and telex equipment to support their activities. There are also sizeable binderies attached to these libraries and these facilities handle jobs like binding and mending of library books, journals and other scholarly publications like theses and dissertations. It has been observed that some of this equipment (e.g. computers) is not widely used; even students do not have direct access to them as a result of lack of expertise.

The libraries recognise that library skills are not acquired naturally by students as they climb the educational ladder. Thus, some form of systematic introduction – a user education programme – is provided to help students realise the full potential of library resources. This is normally done as part of the general orientation activities planned for newly-admitted students. The projected objective of this exercise has not been fully achieved, owing to the large number of students involved and the relatively short time allocated to it.

Registration

Before users are allowed to use the resources in these libraries, they are formally registered. Registration is extended to the following:

> members of university councils, teaching and research staff, senior administrative and professional staff, graduate assistants, postgraduate and undergraduate students and junior staff.

Other persons are registered as authorised users at the discretion of the university librarian on payment of fees and deposits. All potential users are required by library regulations to present identity cards or letters of introduction from Heads of Departments before access is granted.

In the UG and UST libraries, students' registration is valid for one academic year and is renewable thereafter for another year. At UCC, registration is valid for the duration of the students' respective courses.

Satellite libraries

These are located in libraries located in various faculties, schools, institutes and departments and halls which complement library services provided by their central libraries. UCC and UST central libraries not only exercise direct or full control and co-ordinate the activities of these satellite libraries, but also maintain union catalogues of their total collections. They, however, have their own hours of opening and regulations. The Balme library has no direct link with these libraries 'as a result of staff shortage and increased difficulty in the acquisition of materials occasioned by crippling shortage of funds'.[5] Such libraries are, therefore, under the administrative control of the Dean/Director of the institute or schools concerned.

Generally speaking, provision of these services is beset with a number of problems. Some of there are: lack of trained staff to handle these schedules; space/accommodation problems and insufficient funds to procure the necessary modern equipment and materials. Other problems include inability to retrain staff to use, maintain and service this equipment. Normally, local companies (representing overseas companies) are charged with the procurement, installation and servicing of this modern library equipment; and it is supplied at very exorbitant charges. The result is that at certain times some of these services are either poorly provided or not provided at all. It has also been observed that there is fragmentation of the limited resources among the satellite libraries.

Administration

The administration of the university libraries falls on the Library Boards generally, but the day-to-day management of the libraries is the responsibility of the University Librarian. The Deputy Librarian and the Heads of the various units in these libraries (usually Senior Assistant Librarians/Sub-librarians) provide assistance. This administrative organization seeks to bring together the various materials, the human, financial and technical resources of the libraries.

Membership of the Library Board includes representatives of the various faculties, students, the finance officer, the Registrar, the University Librarian and Deputy Librarian. The Academic Boards appoint or elect the chairs of the Library Boards in accordance with the university statutes.

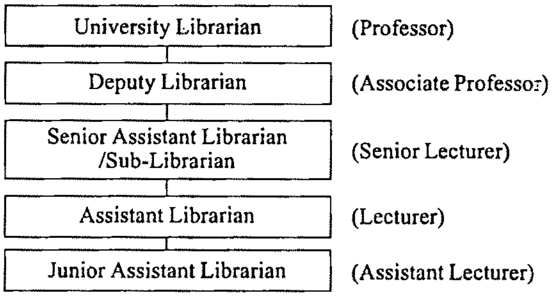
Korsah observes that, 'there is no consistency and uniformity as far as the composition of the Library Boards is concerned. While the bookshop manager of UCC and three elected students are members, UG and UST appoint two students to serve on theirs; their bookshop managers are not members of their Library Boards'.[6]

The major function of the Board is, 'subject to the directions of the Academic Board, to supervise and direct the policy of the library and such other matters as may be delegated to it'.[7] The Library Boards approve or amend the annual reports and estimates prepared by the University Librarians. Thus, the Library Boards ensure that the libraries are well maintained and well developed in spite of the problems they encounter. One major problem is that their activities, deliberations and recommendations will have to be conducted bearing in mind the available financial resources of the universities in general and the budgetary allocations in particular. Apart from the fact that policies formulated by the Library Boards are interfered with by some other committees (e.g. Finance and Development), the short tenure of office of its members (usually a year or two), poses a problem as far as formulation and execution of medium and long term plans or projects are concerned.

Staff and their status

In Ghana, the University Librarian, whose status is equivalent to that of professor, is the head of the library. Below him is the Deputy Librarian. There are Senior Assistant Librarians/Sub-Librarians, who normally head the various divisions of the library – Acquisitions, Cataloguing, Readers' Services, Special Collections and Reference. Others include Assistant Librarians and Junior Assistant Librarians (see figure 1). This group constitutes the senior members (professionals) of the library. The minimum academic/professional qualification(s) required are any one of these: a good first degree in librarianship; the FLA; a good first degree in any academic subject plus the graduate-diploma in librarianship or ALA. Presently, higher degrees in librarianship are preferred, though possession of the minimum qualification with many years of working experience is also accepted. Recruitment into the university libraries in Ghana is uniform and this

Figure 1. Ranks in university libraries in Ghana



(Equivalent academic ranks are indicated in brackets) is mainly undertaken by the various Appointments and Promotions Boards.

The second group, the para-professionals, are those who hold the non-graduate Diploma in Librarianship, the ALA or any equivalent qualification. The ranks range from Library Assistant, Senior Library Assistant, Principal Library Assistant to Chief Library Assistant.

There is a third category, the auxiliary staff, who provide supporting services to the above-named groups. These include junior library assistants, clerical staff, photocopy operators, departmental assistants, cleaners and messengers.

It has been observed that all university librarians, deputy librarians as well as all senior members of the Balme and UST libraries enjoy academic status. Therefore, other rights or entitlements such as sabbatical leave and book allowance besides the normal ones (like equal tenure of office, salary and study leave with pay) are extended to them.

It is often said that a university library should have a sufficient number and variety of personnel to develop, organize and maintain the collection and provide information and reference service necessary to meet university needs. Unfortunately, however, the contrary is the situation in our universities. These libraries are characterized by an acute shortage of staff of all categories, especially cataloguers (Table 2).

Table 2. Staffing position of the university libraries (March 1994)

Name of library	Senior members (professionals)	Senior staff	Others (auxiliary)
Balme (UG)	11	14	47
UST	17	8	35
UCC	11	7	39

Figures quoted for UST and UCC Libraries include staff in the satellite libraries.

Among the reasons for this situation are: the effect of the government's rationalization policy on our universities; rigid recruitment conditions; the general poor conditions of service prevailing in the universities and the brain-drain that hit our universities especially in the early 1980s.

This problem has been highlighted by two university librarians as follows: 'the staffing situation continued to be poor, the year started with seven senior members out of an establishment of twenty. Support staff too were thin on the ground'.[8] From UCC the librarian wrote: 'during the period under review, there were nine qualified librarians at post; this however, fell short of the required establishment...'[9]

It has been observed that the situation is worse in the case of librarians with a science background.

Hours of opening

Hours of opening the university libraries have been fixed by the various Library Boards as follows:

Semester Time

Mondays to Fridays : 8.00am to 10.00pm
Saturdays : 8.00am to 6.00pm

Vacation Time

Mondays to Fridays : 8.00am to 4.30pm
Saturdays : 8.00am to 12.00 noon

The above opening hours may be changed at any time by the Board or at the discretion of the University Librarian, acting on behalf of the Board. It was observed that though UST and UCC libraries open their doors to users at 8.00am, UG waits until 9.00am. During vacation time, these libraries do not operate on Saturdays because of inadequate staff.

Funding

In Ghana, financial support of the universities in general and their libraries in particular has always been a subject of major concern to the Ministry of Education, university administrators and librarians. Matters relating to finance, budget, salaries and book funds have become topical issues at academic and library Board meetings, as well as in information discussions in the universities. This is because finance is the life blood of any service, including the university library. Besides, if a university library is to develop relevant and up-to-date collections, recruit and retain the right calibre of staff, then the provision of sufficient funding has to be considered and determined carefully.

University libraries in Ghana obtain funds through the universities whose sources of financial support are government grants, private contributions and gifts, proceeds from sale of application forms, registration fees, endowments and bequests, investments and consultancy.

Direct collection of funds by the libraries may come from sources such as photocopying services and fines for overdue books. The main source of funding is government grants, which account for about 90% of the total revenue of each university. Currently, the average rate of funding these libraries is about 1-2% of the total recurrent grant.[10] This figure is far less than what the Standing Conference on African University Librarians, Western Area (SCAULWA) recommended in April 1986: 'that African universities should allocate at least 5% of their total budget to their libraries.'[11]

The writer thinks that this should be increased if the collection is deficient or if there is a rapid expansion in student population and course offering.

The libraries are crippled by financial constraints as a result of declining budgetary allocation from the government and increasing inflation. The problem is compounded by the ever rising cost of books and periodicals, most of which are imported. The effect is that books and other materials are not replenished.

There has also been a substantial reduction in overseas journal subscription in recent years apart from the libraries' inability to purchase about 98% of these valuable items from 1979 to 1987. It is observed that in times of economic hardship, when expenditure of the universities has to be reduced, the libraries are the first to be affected.

Library accommodation/infrastructure

The provision of suitable and adequate physical facilities to cater for all the functions of the libraries has been the major preoccupation of the universities.

The history of physical provision for university libraries in Ghana dates back to August, 1959. That was when the Balme library (UG) was moved from its temporary buildings at Achimota to the new one, '...purposely designed and constructed to house 250,000 volumes and accommodate 350 readers.'[12] This building enjoys a special place as the first purpose-built university library in Ghana.

UST library, also transferred from Achimota College library, was housed in temporary prefabricated buildings at the Biological Sciences department. In April, 1961, 'it was moved into its new building designed to accommodate 100,000 volumes and to provide seating for 250 readers.'[13]

The situation in UCC is quite different in the sense that it has not seen any new library building yet. An initial collection of 650 books, transferred from UST library, was housed in one of the lecture rooms in the Arts faculty building in 1962. This was later 'transferred into a temporary building with a capacity for 20,000 volumes and 40 readers in 1963.'[14] This temporary structure has accommodated its collection ever since the library was founded. But to complement the inadequate space in this building, and to have the science books as close as possible to their users, library resources on Science and Technology, Agriculture and some aspects of Medicine were moved to the top floor in the Faculty of Science building during the 1967/68 session.

By comparing these figures with their present stocks, it is clear that these libraries are facing an acute shortage of space. The reasons for this are: steady growth of the various collections as a result of marked interest in research activity; introduction of more disciplines in the social and natural sciences; an unprecedented proliferation of publications – the 'Literature Explosion' in the world covering all subject areas – and the tremendous increase in student enrolment and staff recruitment.

Construction of the new buildings and extensions to existing ones are being carried out piecemeal. UCC started the construction of a new five storey library complex more than a decade ago while UST is undertaking extension work on its existing buildings though it has been under criticism for 'wastage of floor space and absence of flexibility and adaptability, ...badly designed for library purposes. This has come about because of its architecture.'[15]

The problem of inadequate space still persists in spite of these efforts. The situation is aggravated by the poor and ageing infrastructure. The reason is that none of these projects has been completed and handed over for use. The usual reason for this situation is lack of funds, but it has been observed that other factors like unplanned expansion of higher education facilities, lack of interest in or the lackadaisical attitude towards library development on the part of governments and even some university administrators and academics also retard the growth and development of university libraries in Ghana.

Recommendations and conclusion

This paper has not only revealed the existing situation in university libraries in Ghana, but also identified the enormous problems that hinder their efficiency and progress.

The impact of these issues is expected to be felt more greatly in the ensuing years as a result of increased student population, tremendous changes in the information/publishing industry and the general rapid changes in society. These libraries, as individual institutions, will be unable to solve the problems enumerated in this paper, especially at a time when developing countries, including Ghana, are plagued with stringent and controversial economic measures, huge foreign debts and debilitating debt-repayment schedules.

This paper suggests a number of solutions to these problems.

The first to be recommended is library co-operation. No university library is self-sufficient, hence co-operation is inevitable. The Parry Report (1967) has indicated the main types of co-operative activity as follows: inter-library lending, inter-library study facilities, co-operative acquisition schemes, co-operative and centralized cataloguing, co-operative storage schemes, transfer of materials, regional co-operation, library research and professional associations.

Of all the types of co-operative activity, inter-library lending has been regarded as the most important by the university libraries in Ghana. It is, therefore, recommended that all the other types enumerated above should be seriously considered. Although some university library personnel meet to exchange ideas, the writer thinks the meetings and seminars conducted should be regular and more responsive to the needs and aspirations of the libraries.

Most of the problems highlighted in this paper hinge on one major issue – finance.

Adequate funding for these libraries will ensure better and well-equipped physical facilities, building of relevant and up-to-date stock, recruiting, training, retraining and retaining highly qualified staff. Besides, modern equipment and facilities can be provided, and all these will go a long way to improve the services offered by these libraries. The library community in Ghana is represented by the Ghana

Library Association. No academic library association exists to cater for the needs of university library staff but this could be considered since these types of librarians serve different users. There is no doubt that this association will be able to assess and tackle the numerous problems of the university libraries and their personnel.

It is also recommended that the libraries should serve as focal points for all library activities within the universities.

The main and satellite libraries should be brought together to form a cohesive system with common practices, procedures and services. This will also ease the congestion in the main libraries.

Library publications in the form of new accession lists, bibliographies, annual reports, library guides, union lists of periodicals are irregularly issued by these libraries. This aspect of library services should be pursued vigorously, and these publications should be publicised among the university libraries in order to afford users the opportunity to locate various publications available in different libraries.

In Ghana, university Library Boards do not have financial powers, so requests not budgeted for have to be sent to the Academic Board or the university council for discussion.

Thus most vital issues that need prompt attention are delayed to the detriment of these libraries. To forestall this, it is suggested that membership of the board should include a representative each from the university council and the Academic Board. This practice will ensure that matters affecting the libraries are dealt with promptly and in an expeditious manner.

In the absence of a University Grants Committee set up on the lines of what exists in Britain, the Ministry of Education should set up a University Libraries Committee to assist the various Library Boards to see to the proper welfare of their libraries. Again, it will ensure, to a greater extent, that the libraries are adequately catered for in terms of grants to university libraries as against total university expenditure. This committee can also act as a procurement agency to cater for books and journals as well as other vital library materials.

It is further suggested that extensive weeding of collections, bearing in mind the academic and research needs of the institutions, should be carried out periodically.

Relying on foreign donors and foundations has to some extent been successful as they donate numerous books and journals to our libraries. The writer suggests that this should be improved and carefully done to ensure that worthless materials do not enter our libraries. Foreign donors like Overseas Development Administration (ODA), Canadian Organisation for Development through Education (CODE), the British Council and their local representative, Ghana Book Trust, which are conversant with the real needs of these libraries, should be encouraged to help.

The publishing industry in the country should be revitalised to support these libraries. Towards this end, credit facilities could be extended to them to purchase the needed inputs. Cumbersome procedures, official red-tapeism involved in obtaining the necessary import licence, difficulties in custom clearance and problems involved in payment that plague this important industry should be eliminated.

Finally, the importance and worth of university libraries and their librarians should be strongly upheld by the government, university governing boards, university administrators and other policy makers in the educational sector of the country.

It is only when this is done that these libraries will be able to meet the stated purposes, goals and objectives of the institutions of which they are part.

Conclusion

The need for the establishment of universities and consequently the provision of quality university library cannot be overemphasized. In Ghana, however, the importance of the library as the 'heart' of the university has been overlooked over the past years. Now, there is a reverse in this poor state of affairs because of the recognition that university libraries are number-one agents in supporting teaching, study and research activities of the universities. Other possible reasons for the rise of the importance of university libraries in Ghana are: emphasis on research in recent years, the introduction of multidisciplinary M.Phil. and Ph.D programmes and increasing emphasis on scientific and technological programmes as basis for national development. Besides, faculty members, who need publications for their promotion and recognition in their respective areas of scholarship, rely more on the university libraries for their book and journal needs. The reason for this is that they are unable to build their own collections owing to high cost of books and periodicals and non-availability of these items on the local market.

Thus, it can be seen that the university library performs a Herculean task and responsibilities that call for the co-operation of all and sundry. University administrators, students and faculty members as well as officials from the Ministries of Education and Finance should not forget that the library must attempt to match the infinite expectations of its readers with a very finite budget for books, staff and space.

It is only when the library is given its due place in the university that its main purpose of existence can be fulfilled.

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Retrieving art images by image content: the UC Davis QBIC project

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Abstract

Under the direction of Conrad Atkinson, the University of California at Davis's Department of Art and Art History is using QBIC (Query by Image Content), a visual query software program currently under development by IBM, to determine how effective it may prove in retrieving art images based on what they look like, rather than relying on text indexing. Beginning in January, 1993, in a joint research project with IBM, we began the construction of a pilot database of art images selected from our slide library. This paper will describe the construction of our pilot database, and will present preliminary findings.

Introduction

The Art and Art History Department Slide Library currently houses over 200,000 slides and serves as a visual resource on the Davis campus for classes taught in the department, as well as classes across the curriculum. Interest in creating an electronic database was prompted by the way that faculty and graduate students use the collection. Librarians from both the Fine Arts and Slide Libraries frequently deal with requests for images based on content – 'Who did (images depicting)...?' Because our user population is diverse, many patrons are unfamiliar with art historical periods or terminology, and in any instances, are interested more in what an image depicts than who made it.

A typical example is a professor in Wildlife and Fisheries Biology who is researching 'fish in art' for a publication.[1] The Fine Arts and Slide Librarians, both art historians, and both familiar with the slide collection, given a little time, can usually find a range of images that would prove useful to the patron. But this means stopping whatever task is in progress and spending some time with the patron, pulling slides from drawers, consulting with the patron, and refining the search. In the face of continuing budget cuts and declines in staffing, we have been ever mindful of the time consumed by this activity. The process would be more efficient, and certainly more comprehensive, if it were possible to conduct such searches electronically. Searches could be conducted by the individual patron without relying on the staff. Further, an electronic database and searching capabilities would save money because slides would not have to be pulled and refiled, and wear and tear on the slides would be kept to a minimum. An added bonus would be accessibility to students who do not have slide library privileges, who would be able to view images online from the Art Library. Because it would be possible to identify subjects across a range of time, in different locations, new information about the use of visual elements by different cultures might be possible. New research and teaching possibilities would appear as a result.

At the onset of the project, we proposed constructing a pilot database of 1,000 images that would be selected by the art and slide librarians based on their reference experience. Because the labour involved in selecting, scanning, and annotating slides would be the largest cost of creating the database, we felt that it was important to scan the images carefully and correctly the first time. We anticipated that the hardware would be replaced many times, but we would not be able to afford rescanning costs. Our initial intent was to scan the images at the highest resolution appropriate for the quality of a given image and at 24 bits of colour.[2]

We conducted a survey of faculty in the department to identify areas that they might use in their teaching if such a tool were available. The results of this questionnaire, plus the contents of a log of reference questions, formed the basis for image selection. After scanning began, we modified somewhat the image selection criteria. A small percentage of the images that were easily readable in slide format we found to be too subtle to be easily read when scanned without spending an enormous amount of time enhancing the scanned image, especially if an image contained fine detail in low contrast. As a result, we refined our selection process to focus on images from the slide collection that contained clearly readable elements that would lend themselves to visual searches.

The QBIC software is designed to work with images in a more visual way than text-based image retrieval software, and is thus appealing for our application. Often searches are based on what things look like, rather than using words to create description. Therefore, while software such as University of California at Berkeley's ImageQuery uses text to describe an image and its properties, and can be useful, for example, to find contemporary paintings, reclining nudes, etc., QBIC attempts to find things that look similar to a selected shape, colour or texture. QBIC provides an enhancement to text indexing, offering a more comprehensive searching tool. Text indexing is included in the database, and can serve as an effective beginning for a search.

The type of image-based retrieval offered by QBIC is useful for situations where images cannot be accurately described in words, especially when used by people who are strongly visually oriented. On the other hand, text-based searches work well when the name of the artist, or the image being searched for is already known. Thus, an artist's name – Degas, or Cassatt – can be easily searched, and subject matter such as 'horses' or 'altarpieces' can be looked up, and corresponding references found (assuming such text annotation has been entered). Other types of descriptions, especially in the area of art, can be named only visually, as in a type of brushwork, a texture of material, or a specific colour. Searches such as these, based on linguistic terms, become highly subjective, based on each namer's subjective choice of words.

The Art Slide Library's collection of over 200,000 images is catalogued by medium, geography, and chronology, and in some cases, not yet catalogued at all.[3] Within these arrangements are a plethora of subject codes to describe and categorize further. These codes are neither fully objective nor universal, a problem when locating images if the artist's name, or the work's title is not recalled, or when looking for relational images. Thus, problems arise in instances involving judgement calls as to what an image really is. Was Gauguin a Post-Impressionist, or a Symbolist? The problem of cataloguing contemporary art is further frustrated by the developing ideology and the attendant changes in the meaning of terminology. The work of artist Victor Burgin could be called photography, image-text, or conceptual art, depending on who names the categories. Categories such as these become problematic for different types of people looking up visual work. QBIC avoids this problem by allowing visual elements to be classified/catalogued, without having to assign a text term that will be agreed upon by users of the database.

Many of the Art Department faculty are exploring aspects of critical theory in their teaching and research. As a result, an additional aspect of the Art Department's involvement in using this software was to see if the attributes computed by QBIC could pick up areas as subtle as race, class, and gender in a given database. This highly specific question was kept in mind in the initial selection of images.

Constructing the database

1. Selecting the images

An initial set of images was chosen based on results of a survey of Art Studio and Art History faculty. An additional set was selected that contained obvious visual relationships to the issues of race, class, and/or gender. Visual problem sets were selected by the librarians based on reference questions regarding specific visual elements: fish, horses, hands, reclining female nudes, phallic symbols, drapery, textures, skeletons, text used as a component of artworks, and perspective, were also chosen. The images for the pilot study were limited to existing slides owned by the Art Slide Library. A small group of slides taken from actual works in the collection of the Richard L. Nelson Gallery and the Fine Arts Collection at UC Davis, were also used.

2. Scanning

Because of limited online storage capacity and large image size, all the images were scanned at 1,000 dpi and at 8 bits of colour, and even then, there is the storage capacity for only about 700 images in the 1gb allocated to us on the RS-6000, the host where the database resides. (Currently the database has approximately 700 images.) Each slide is scanned on a Kodak RFS-2035 Professional Slide Scanner at 1,000 dpi, then converted to 8 bit indexed colour to save space. This was chosen as a compromise to maintain good colour and image resolution while achieving maximum storage capacity. The images are colour corrected, cropped, and spot toned in Adobe Photoshop 2.5 on a Mac Quadra 950 and saved as TIFF files, each image averaging 1 megabyte. The images are then downloaded as binary files to an IBM RS-6000 workstation which runs AIX windows, into directories in the QBIC software. Each image was assigned a 'Q' number that corresponds with the slide accession number, and supporting text giving the artist's name, and a brief title.

3. Classifying the images

QBIC provides various forms of image queries. The two general forms are as an 'object query', or as an 'image query'. Object queries retrieve images containing objects which match query specifications, such as 'Find shapes that are red and circular,' whereas image queries match overall image characteristics, for example, 'Find images with mostly red and blue tones.' To do object queries, the objects must be identified in each scene, typically manually by outlining them prior to the queries. The process of outlining objects, and then of computing attributes or features for each object and for each image as a whole is referred to as image classification. There are basic drawing tools such as a rectangle, ellipse, polygon, paint brush and a snake tool, which outline the selected images. A fill tool expedites the masking of high contrast images by automatically outlining pixels of a similar value to one selected.

Classification of images is more or less labour intensive, depending upon the number of visual elements that are selected for classification and their nature.[4] Objects to outline were chosen based on the afore mentioned test subjects, thus shapes of horses, hands, etc. were always carefully outlined. Many other shapes were outlined that looked interesting, or applicable. Various colours and types of patterns and textures were masked into a rectangular shape. Anywhere from 1 to 10 masks were created, although it is possible to create any number. In the QBIC project each image averages 3 or 4 masks. The masks are displayed through translucent overlays in 7 colours and can be displayed simultaneously or singularly. The feature/attribute computation that is done for each object and each image computes parameters describing the colour, texture, shape, and location of the objects. Additionally, each mask can include a text reference that can be used as a query tool, as can a text reference, that includes title and artist, for the complete scene.[5]

How QBIC works

Once the database has been classified and updated, QBIC is ready to search. There are 9 possible searches that can be conducted, each selectable by 'toggle buttons' that enable/disable the search criterion. There are also 'picker windows' for each type of search. Each picker will be explained in the context of its searching capability. The different searches are as follows:

1. Scene text refers to the whole image, sans masks. The text is based on the name of the image (the Q number, artist's last name, and brief title.) There is also an entry space in the editing window where all of the information from each slide will be entered, which will include the full title, full author's name, the date, region, and subject codes based on the Art Slide Library's subject coding.

2. Scene histicolor searches for a specified percentage of up to 5 colours from a choice of 256 colours, using the Munsell colour system. For this function as with all the functions to follow, images can be displayed as an example to base colour choices on, either in the editing window, or in an additional small display window. Settings for histogram searches can be set manually, or the software provides an option to display the most frequently occurring colours in a given image along with their percentage in the image, and the results may then form the basis of a query.

3. Scene RGB colour features a picker window which allows a mixing palette to create colours based on red, green, and blue. Once a colour is mixed, which again can be matched to a displayed example, the query will bring back a scene in which this is an overall colour.

4. Scene texture searches based on an expandable texture menu, which amounts to an expandable visual thesaurus. Textures can be chosen by the user and installed in their own directories. When the visual menu comes up, from the texture picker, the user simply clicks on a texture, and QBIC searches the database for a similar pixel pattern in an overall scene. This is quite general at the scene level, and is typically not suitable for entire artwork images which have complex and varied compositional elements.

5. The **Shape search** is the first search that uses the object outlines (masks). There are two ways to initiate a shape search. The first way to is to bring up an editing window, and draw a shape on a blank background, using the same drawing tools that were used to create the masks. This can range from a simple geometric shape to a complex realistic shape. The second method is a search by example initiated from an image displayed on the screen. In order to do this, the user displays the 'clips' from the image – thumbnails of the elements in the image that were classified. Either method of shape search can then be combined with an RGB colour search, histicolour search, texture search, or text search. A shape/texture search, for example, would consist of the user either bringing up a clipped outline from an image, or drawing a shape in the editing window. The user would then select a texture from the texture menu, click on it, and QBIC will search for that texture within similar shapes.

Once an initial query is done, a selection of 'hits' is displayed. QBIC can be set to retrieve 10, 20, 50, 100, or 200 hits, or may be set to retrieve all of the images in the database. They are displayed in descending order of closeness to the example. An expandable holding area can display 12-48 images at a time, with a scroll bar to look through the remaining images. Hits can be held in a holding window, either one by one, or as a group. This allows the user to have a selection of images to use for reference, or to query against.

6. Query by example is used when a group of hits has been selected. By clicking with the mouse on an image displayed as the result of a query, that image can be displayed, either in an editing window or a display window, held, or used to initiate a query of the form, 'Find other images like this one.' This is the most useful and accurate way to do a query, as it allows the user to find an exact shape, texture, colour, etc. and attempt to find others that are very close. A variety of images can be held, all of which can be queried from to find a range of images. This allows the user to browse rapidly a large number of images, and to use images selected as a basis to refine and expand the search.

Examples of typical searches

A typical accurate search may work like this:

First a text search of an artist's name may find all the images in the database by a certain artist. The user would choose the scene text picker and type in an artist's last name, Hollowell, for example, after David Hollowell. QBIC would instantly retrieve the David Hollowell images in the database. Then the user may be interested in a more specific element of one of these. Perhaps the shapes in Hollowell's painting, La Galleria. The user could place in the holding area the masks of the painting. Enabling shape, the user would click on a thumbnail of the masked area in the painting, and see what images are found as matches.

Another search may be for subjects depicting people of colour. The user may first type in an artist who he or she knows deals with such subjects in their work. Faith Ringgold, the African American textile artist and painter, is a good example. From the 5 Ringgold works in the database, several of the masks are figures or faces of people of colour. The user would put these images into the hold, and continue to query on these by example, enabling the histogram colour search. Eventually, after scrolling through the selections queried on, QBIC generally finds about 16 different faces and figures with similar skin colours after about 5 queries.

There are unlimited possibilities in the types of queries that can be done, and the paths taken by the user to get to something. A user conducting a very specific type of search would combine text searches with the visual searches to comb through the images when looking for relational images.

Preliminary results

Our initial results are quite variable. For example, searches for shapes in fine art images are problematic. Shadows and light, and differences between drawing, painting, sculpture, photography, prints and textiles can all make too much of a difference in the same subject for the software to pick up similar conceptual subjects that have slightly similar shapes. Shapes in fine art overlap and have ambiguous contours. These differences make the shape element of querying less accurate. A good example are the images of horses. The database contains approximately 38 images in which horses have been masked. These include horse sculptures, paintings and photographs. The horses are positioned from the side, front, back three-quarter view etc. When a query is done from any of these, generally only 3 or 4 horses are retrieved form each example which is queried from. Because of the difference in views, the software cannot discern between horses if these views are significantly different. While the human eye can know that it is a horse, electronically, the shape is not

[redacted]

ties of race, class and gender; this also is proving interesting. There are many faces classified in the database. The outlining is generally of the face only, not the hair, as this creates a huge difference in shape. But when a face shape is drawn in the user shape drawing pad, and a histogram colour palette mixed up that matches a displayed image, of say, Manet's Olympia, which contains a black woman, the matches are frequently finding many other faces of a similar colour. Besides the difference in shape, the skin tones vary greatly. Within painting, skin colour varies between realistic colour and expressive or conceptual colour. A photographic image in black and white of a black person is generally different too. Even in figure sculptures, the whole subject is generally the colour of the sculpture material, rather than a realistic skin tone. However, this has been proving more and more accurate, especially when a group as large as 50 hits are produced, that can be quickly scrolled through, selecting out the thumbnails and holding them, then querying from those held examples. Class and gender have the same difficulties, but are increasingly proving more accurate. In combination with text-based searches, the results should be very interesting as the study progresses.

The most accurate searches are turning up in the areas of colour and texture as not related to a specific shape, or within the rectangular shape that was used for the classification sample. This has also demonstrated a good amount of accuracy with different patterns which were annotated and saved in rectangular shapes. Simple shapes such as circles and other geometric shapes generally are quite accurate. Histogram colour, which searches for the main percentages of colour, proves most accurate when combined with a shape search.

Early this spring, the x-terminal allowing student use of the database from the Art Library has come online. We are now beginning to deal with the problems associated with multiple concurrent users of the database, but we have been pleased to find that response time for searches has been measured in seconds, in spite of the less than optimum quality of the network connection to the RS-6000 that is currently in use.[6] As would be expected, complex combination queries take longer that simple ones, cently received a 4gb hard drive, on loan from IBM, that has been installed, allowing us to expand our system with additional online storage capacity. We are researching the possible use of compression to expand storage, thus providing space for additional images, but also allowing us to use images at 24 bits of colour. We will also continue to refine our methods of image preparation and object outlining, and of image query, combining content-based queries with text. We are quite excited about the possibilities outlined here. It is a privilege to participate in the use of software on the cutting edge of visual retrieval, especially as the whole Art Department is slowly embracing electronic communication on the Internet, and beginning to integrate different applications of computers into the art curriculum. As soon as the system is fully up and running, it is probable that new relationships between images will be examined on a regular basis, allowing for new questions about the nature of images.

NOTES

1. Requests such as this are quite common. The library deals with students across the disciplines who are encouraged to explore the depiction of the subject they are studying in art, across time periods and geographical areas. Similar requests are made by students who are enrolled in art practice classes when they hit a snag in their class project and need to see examples of how other artists have dealt with the problem.

2. The slide collection contains images from a variety of sources that vary considerably in quality. They range from high quality archival records of works of art to slides made from books and exhibition catalogues.

3. When we started this project there was no 'catalogue' for the slide collection, other than the cards that accompany the slides in the drawers and labels on the outside of the slide drawers. As we began the creation of a visual database, we began the parallel task of creating an electronic 'text' catalogue of the slide library collection, with uniform terminology, and consistent format. This is a slow and labour intensive project. The need for a uniform catalogue style and terminology is of increasing concern to all archivists as they construct digital databases that must be used by people from outside their institutions. Because of the lack of adequate staffing, we are concentrating on new accessions, and have been slow to add cataloguing for the QBIC database.

4. The process of classifying visual elements in an image using the QBIC software is probably no more time consuming than using conventional text systems, and perhaps takes even less time, because one doesn't have to deliberate between alternative text categories. Also, one doesn't have to contend with changes in the use of terminology.

5. As the text database of the slide library is constructed we will transfer complete cataloguing information to the visual database using flat file transfer.

6. The University is in the process of installing a high speed fibre optic broad band network on campus. The Art Building has priority placement on the schedule for the broad band network, both because of the QBIC project, and because of the Department's developing program in digital imaging and interactive video.

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Explicit representations: approaches to censorship

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Abstract
The censorship of moral, literary and artistic materials is an important aspect of information control. Systematic study involves the researcher in analysis of specific cases and situations, an exploration of relationships between law and literature, and an understanding of gender roles, the media, and the pornography industry. Important definitions need to be clarified and assumptions examined, making this domain both complex and rewarding for social information analysis.

In the modern world there is much talk about information flow, about access and enabling technology, and about information rich and poor communities. The information flowing about may be facts and figures, neutral and objective. But things are not as simple as this. Information is often value-laden, full of connotations to different people, and interpreted in adversarial ways by opposing groups. It may well be information of a sensitive kind, about controversial or personal matters. At this point issues of information control usually appear. So it is that information flow is a term we can easily extend to areas of censorship.

There are several such areas – political (e.g. official secrecy and privacy of the individual), religious and moral (e.g. what behaviours are allowed), literary and artistic (e.g. what is considered acceptable to a community). Examples of these can be found in many periods of history, and reference can be made to many types of media, from engravings to computer games. Often, there are complex and contradictory pressures at work, as when works have literary and artistic merit but are regarded by the community, or a part of it, as offensive or unacceptable for, say, religious reasons. Time may change the perception of a work, so that we can look back at the hypocrisies of Victorian morality with some amusement and wonder what all the fuss was about. Even within our current generation, the *cause célèbre* of *Lady Chatterley's lover* has become a historical curiosity. The author's intentions can be misconstrued, the response of the implied reader regarded with caring suspicion, and social harms alleged.

Censorship and the offensive

Of all these many approaches this discussion focuses on information flow as it applies to moral, literary and artistic issues. It looks at censorship with particular attention to obscenity and pornography. Its intention is to review some of the major subjects likely to confront the student, point out important areas of debate and protagonists in that debate, and consider the implications for people involved in teaching and learning in this area.

As a subject of investigation, censorship has its own particular hazards, not least of all that many regard it sceptically as some form of sociologically rationalized diversion. Moreover, it is a field where clichés and stereotypes and prejudices abound, about what is erotic and offensive and a legitimate subject of study. It is sometimes trapped between the view that the obscene should be kept private and not made public, and that full and open discussion and review are essential in any free and enlightened society. It is caught, too, between critics who argue for a mindless relativism in moral and artistic assumptions and those who regard any free expression which offends a significant minority as unacceptable. Formal study presents its own unique logistical challenges, in getting access to appropriate primary materials, especially the most explicit, sources of supply and purchasers and users. Research in the area presents ethical problems to the researcher in terms of confidentiality and morality, and even safety.

At the same time, there is the principle in many societies of freedom of sexual choice, of moral independence. Linked with this is the matter of freedom of speech, expressed most notably in the First Amendment to the US Constitution ('Congress shall make no law... abridging the freedom of speech, or of the press'). These issues have important implications for law and morality, authorship and publication, and many of the best-known cases of literary censorship, like the William Burroughs's *Naked lunch* affair back in the 1950s, demonstrate this conjunction very well. Associated with freedom of sexual choice and expression is the extent to which any society is willing to permit or able to prohibit 'sexually explicit' materials, and what mechanisms can realistically be put in place to implement such decisions (e.g. controls on postal services, customs, publishers), and whether the law (e.g. statutes or the courts) are effective and appropriate vehicles for such control. There is also the issue of things that are

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private and those that are public. It can be argued that when private acts are made public, particularly for commercial gain or public titillation, as they may be on the media, then they may become offensive and exploit both the consumers of the product and the actors in it.

This leads us inevitably to what is regarded as offensive, and in what respects it offends, and who thinks so. The classic Hicklin 'test of obscenity' argues for depraving and corrupting those exposed to or exposing themselves to, say, a book or picture or film which has offensive content. We are obliged to consider what 'offensive' means, and by what criteria being offensive is judged. Being offensive, of course, may entail a purported attack on current standards of morality or sexuality, but it could also involve an alleged onslaught on good taste (which is an artistic issue) or decency (what is indecent may not necessarily be offensive) or impropriety (which concerns itself with codes of etiquette and conduct, and may be entirely trivial or ephemeral). Definitions are numerous and often contradictory, even between experts: for instance, sexually explicit materials may not be obscene in intention or effect, while controversial art, like the homoerotic photographs of Mapplethorpe, may provoke a simultaneous acceptance of their right to exist as art yet a strong personally held view that they are likely to offend many viewers.

The term 'obscene' has taken on new connotations in recent years, moving it from the locus of morality, sex and violence, into a broader domain where, say, international business which violates the environment, or genocidal war which leaves thousands of people to die on our television screens, is regarded as 'obscene'. In this discussion, obscene is used to denote only that constellation of issues which may be associated with sexually explicit and offensive material, including violent material, and those aspects of obscenity which are most likely to concern critics, sociologists and lawyers when they review obscene publications in one form or another.

Sexuality and consensus

At the heart of the matter is the ambivalent factor of human sexuality itself, and our ever-changing attitude to it. Sexuality is both exciting and degrading, an elevated expression of love and a participation in dirt, a normal human activity and an opportunity for lust and deviancy. This ambivalence gets strong support from the very semantics in which it is expressed, for terms like 'normal' and 'deviancy' open up a further series of important social and moral questions about what is considered normal in society, how moral and sexual paradigms of normalcy are created and sustained and overturned, and where deviancy – if it exists – starts and ends. We are forced to consider the social and moral context of any controversial work and of any critique of it, in order to understand the response and what motivates it. The history of censorship is full of examples, demonstrating the power of institutionalized religion or a dominant moral grouping (e.g. the Roman Catholic Index of forbidden books or Comstock's Society for the Suppression of Vice in America), and the ways in which producers sought to regulate their own practices in order to survive or appease (e.g. the Hays Code in the Hollywood of the 1930s).

It is useful to consider the assumptions on which such social consensus about morality, art and literature is constructed, and the extent to which there really is a consensus, or if it is an ostensible consensus arising because there is a powerful voice, institutionalized or not, claiming it is so. One major assumption is that of harm: that exposure to sexually explicit materials causes antisocial thoughts, ideas, and behaviours in people exposing themselves to it. This 'harms caused' argument has proved very influential over the centuries, even though evidence from sociologists and psychologists is mixed. Even apparent 'proof' that exposure, particularly over a long period, has the effect either of precipitating antisocial impulses or desensitizing the subject (say, to the effect of predatory sex on women, or to the powerful association between sex and violence) has failed to convince many in positions to change social mores and attitudes.

One reason for this, of course, is that the proof itself is suspect. Moreover, much of the evidence is regarded as unrepresentative, say, like laboratory-based tests carried out in unlifelike conditions on atypical subjects like rapists and child-molesters, or studies which concentrate on children and young people. Studies like these sometimes fall into the trap of arguing that the majority of 'reasonable' people should be treated in particular ways, like not being allowed to see certain films, because research subjects or 'susceptible or vulnerable' subgroups appear to respond in alarming ways to artificial stimuli. This area of the debate brings together two key ideas, that of harms caused and that of the reasonable person, and for the average citizen the multi-disciplinary research implications of these, and the evidence it throws up, cut very little ice beside the liberal and individualistic claim of moral independence that most citizens assert as their right, on their own behalf or that of their children and family. Even cases like that of James Bulger in 1993, while they cause a temporary zone of concern, fade as a generalized self-confidence about personal morality takes over again.

It is often necessary to get students to consider their own position. A challenge of any course on censorship is to do this. A student may hold strong private views about what is morally acceptable about pornography but not wish to declare those views in public. All the views we hold on matters like this are affected by our own experience, which is often less worldly than we would care to admit. We may often find ourselves inveigled into discussing issues which we feel we know little about, and which we would not wish others to know we knew about for reasons of reputation and respectability. Certain views may be unfashionable in the student peer group (e.g. a fundamentalist or literalist religious view of morality, or of gay porn). On the other hand it may be possible to elicit some degree of consensus over activities or portrayals which a majority regard as offensive (say, sex with animals, pederasty or incestuous abuse), or if not these activities and portrayals, then the morality of turning them into commercially available and lucrative products or events. In a similar way, it is possible to elicit areas of dissension or disagreement (e.g. over computer games and alleged violent effects, or oral sex, explicit language on television, or delegalising cannabis) and explore likely reasons for different viewpoints (which can be influenced by background, age, gender, role as parent, role as professional teacher or librarian, and so forth). Mapping the so-called thresholds of the tolerable in this way can provide an insight for the group of students into its own membership, and successfully decouple the result from any model explicitly or implicitly presented by course organizers. It can also lead to a consideration of how, if at all, society can and should monitor and contain sexploitation and the generally offensive, and the extent to which law, in the form of the police and the legal system, is effective in doing this.

The ambivalence of our attitudes to sex and violence is in itself a subject for investigation. Our attitudes to dirt and smut are complex. We traditionally regard clean things as good things, and dirty things as embarrassing or unpleasant. Tropes abound in literature, from defecation to corpses. The Puritans held that cleanliness was next to godliness. There are anthropological and ideological undertones to this debate, pointing to the split-level lives we all lead, caught between public and private, the aloneness of self and union with a partner, and the association of sex with beauty and dirt. Religious ideology may place this within a Jehovanist context by stressing how God, particularly in the Old Testament, identified sex with having children, and how, in later periods, the idea of enjoying sex, particularly for women, was frowned on as a kind of libidinous abuse. The terminology used, like 'libido', suggests how important language is for any understanding of dominant meanings and representations within any historical period, an approach to epistemology associated with Foucault. Anthropologists of pornography like Jack McIver Weatherford identify masturbation as of particular interest, suggesting that in the West it rates as a major source of sexual gratification, in distinction to other peoples of the world, and that this is often the result of living solitary lives where fantasy becomes an essential element in sexuality. The pornography industry is based to a large extent on this factor.

Any systematic course on censorship should spend time considering the nature and scope of the pornography industry. An initial challenge for this lies in knowing where it actually starts: is it page 3 images in tabloid newspapers or in sexist advertisements, keep-fit videos or naturist magazines, romances which go beyond the bedroom door and bodice-rippers, *Mayfair* or *Penthouse*? Hagen-Daz ice-cream and Benetton advertisements are certainly worth examination for their marketing appeal and intended effects. The porn industry has business connections with major magazine and publishing interests worldwide. At the same time there is a more specialist side to it, where thousands can be made by international producers like Rodox and Beate Uhse. Material is often targeted at consumer groups wanting anal or gay or child sex. Counterfeit and bootlegged video porn is a worldwide industry. Promotion is sophisticated and dissemination widespread. Many specialized outlets, like zines, advertise sex adventures and therapies, and it is very likely that advertisers will move on from satellite and cable narrow-casting to the Internet itself.

Again, the assumptions both of the student and society at large play an important part, because such assumptions will almost certainly affect any study of organized porn. To simplify, some may regard it as a major source of corruption in society, requiring the severest measures of censorship underwritten by strict laws enabling police to search and confiscate, and restricting the growth of outlets like sex shops. This view argues that the material will move people to antisocial sexual activities, offend the sensibilities of many reasonable people in the community, advocate or endorse improper ideas about sexual behaviour, inflame the sexual imagination of adults and harm children and vulnerable (Kalven). In purveying obscene products for commercial gain, the porn industry allegedly causes offence and outrage, stimulates sexual excitement without engaging the emotions (i.e. lust without love), dehumanizes sex (e.g. participants are often seen more as organs than human beings), and harms people who read, see or hear it or take part in its production. These are all well-rehearsed arguments, and all beg questions, deserve devil's advocacy, on various grounds from harms caused to an individual's right to sexual freedom within the law. Even active users of pornography appear to be divided according to recent research (Cohen), some arguing that it is a harmless adjunct to a full and balanced life, and others that it is symptomatic of a sick and repressed society.

Law and literature

Any affront to community standards usually provokes some form of sanction, often in the form of law. Censorship is an interesting area of study because it encourages us to approach law from the social and moral viewpoint, accepting that much of the pressure placed on individuals living in society, and placed by us upon ourselves, derives from what might be called extra-legal factors. Among these are

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a wish to be accepted and not offend our neighbours, and to conform, at least in public, with community norms about morality, family life, and professional conduct. Indeed, 'contemporary community standards' is a phrase which often appears in legal statements on censorship, say from the American Supreme Court over the last few decades. Justice Brennan's famous 'three-part test of censorship' suggests that three elements must be present when we consider a work: first, whether the dominant theme, taken as a whole, appeals to a prurient interest in sex; second, whether the material is patently offensive because it confronts contemporary community standards relating to the description or representation of sexual matters; and third, whether the material has any redeeming social value. These remarks were made by Brennan in respect of the American trial of Cleland's famous *Memoirs of Fanny Hill* in 1966. Later, Justice Burger, in 'Miller v. California' (1969) added that it was important that 'the average person' should apply the community standards to the work, taking it as a whole, considering whether it depicted sexual conduct in a patently offensive way as defined by state law, and taking into account whether it had any serious literary, artistic, political, or scientific value.

Such discussions bring together strong legal and intellectual criteria and encourage the student to consider the extent to which any controversial work is regarded by everyone or just be a few as offensive, and how, if at all, a balance can be drawn between the offence it appeared to cause and any intrinsic merit or value the work (book, picture, film, sculpture) had. Coming up through the middle of this dilemma is the perennial dialectic between the administrative 'establishment', variously characterized as institutional and hegemonistic or acting for the public good, and the artist-creator, variously portrayed as individualist, advocate of freedom, anarchist, literary critic and aesthetician. It was this debate which led to literary cases, like those of *Lady Chatterley's lover* and *Last exit to Brooklyn*, being tried in the courts in the 1950s and 1960s, but increasingly thereafter the debate moving out of the law courts into a more general public domain (which allowed for individual claims of defamation, illegal commercial activity, and nuisance). As was said at the time of the Penguin Books D.H. Lawrence trial, were judges the best ones to arbitrate on matters of literary and artistic taste in law courts where experts and juries tended never to see eye to eye?

The law is of critical interest for itself as well as for its role in influencing the production and availability of controversial materials. A distinction is usually drawn between what is indecent, which merely embarrasses the sexual modesty of average people, and what is obscene, which is much more serious. Under the Obscene Publications Act of 1959 a work is liable to prosecution if the effect of it, taken as a whole, is such as tends to deprave and corrupt persons who are likely, in all the circumstances, to read, see or hear the matter contained or embodied in it. Depraving entails making someone bad in moral terms, and corrupting entails destroying their moral purity. As an effect, it goes a long way beyond merely upsetting people. The Act was enhanced in 1964 by an additional factor that dealt with purveyors like publishers and booksellers and stationers who had such materials for 'publication for gain'. The main defence to an action for obscenity is to claim that publication was for the public good. This might involve being in the interests of art of literature or learning generally, hence the involvement of experts to judge whether this interest was being served. There are many other relevant aspects of law, from that which seeks to curtail the display of obscene materials in a public place and to prevent the circulation of indecent photographs of children, to powers given to the customs and postal services to stop suspicious materials in transit. The distribution of potentially offensive materials can be seen as being critical to the commercial success or failure of some products (like films), and in the inauguration of self-regulating mechanisms in some areas of publishing and the media (like the British Board of Film Censorship, later Classification), with all the interesting tensions such inventions precipitate.

For the student of literature and the arts, this area of censorship is of particular interest. Back into history intellectual ideas have provoked criticism and censorship. Indeed, Socrates himself was put to death for corrupting the youth of his time. The Roman Catholic Index Librorum Prohibitorum came into existence in 1564 and survived in France until 1774 and in Spain until 1834. Dr Thomas Bowdler produced his own sanitized versions of the plays in the Family Shakespeare in 1818. Later the most famous cases of literary censorship include the publisher Vizetelly and Emile Zola's *Germinal* (1880s), James Joyce's *Ulysses* (the version in the 1920s, over which Bennet Cerf of Random House argued the case for 'l'homme moyen sensuel'), Frank Harris's *My life and loves* (1963), D.H. Lawrence's *The rainbow* (1915) and *Lady Chatterley's lover* (from the 1920s to the 1950s), Radclyffe Hall's *The well of loneliness* (1928), Henry Miller's *Tropic of Cancer* (1934), Vladimir Nabokov's *Lolita* (written in the 1940s, published in 1958), William Burroughs's *Naked lunch* (1959), *Playboy* going full frontal ('going pubic') with a centrefold in 1971, and Robert Mapplethorpe's homoerotic photographs in an exhibition and book form (1989).

Each of these events has a rich social and literary and moral framework to it, each provoked strong reactions from groups within society, and each ended up facing the strictures of the law. Brennan's three-part test of censorship and the sentiments and assumptions of the Obscene Publications Act can all be profitably applied to these incidents. Such an application demands that any student consider both the law and the broader social context, contemporary community standards moral and literary, and examine the actions and motivations (as far as they can be established or inferred) of the authors and the publishers. There are times, too, when the matter of social or artistic value is difficult to determine, notably when controversy rages over episodes in works like *Last exit* which some regard as sociological realism and others regard as titillatingly offensive. A further dimension is added in cases like Cleland's *Fanny Hill*, published in a different age (the eighteenth century), with an added patina of respectability from being one of the erotic classics of all time; like the *Kama Sutra*, where love techniques arise naturally out of a philosophical and religious setting; and like works of sex instruction for children, where times and national customs vary and parents agree or disagree.

Censorship, media and gender

The effects of censorship on creativity are many, from cutting short the careers of promising writers or pushing them underground, to operating in subtle and complex ways on mainstream methods of production like television and the press. There are codes of conduct which concern themselves with such issues as limiting scenes of gratuitous violence and sex. The ITC Programme Code discusses good taste and decency, sex and nudity, jokes about personal disability, behaviour easily imitated by children, reporting factual programmes, and the effect of TV cameras at demonstrations. Media law operates with varying degrees of success in areas like defamation and contempt of court. Similarly the Code ofPractice of the Press Complaints Commission identifies the identification of children in sex cases and victims of crime as particularly sensitive, as well as intrusions into grief or shock. The extent to which the media observe these codes and laws, and whether what is of interest to the public is also in the public interest, are questions well worth investigation by any student wishing to understand our contemporary media. More specific is analysis into sexual representations in advertisements, the frequency and character of violence in normal television programming (e.g. acts per show, relationship of such acts to the plot and the time at which the programme is broadcast), what implicit attitudes emerge about any sexual act represented on screen (e.g. approval or disapproval), and whether there is any likelihood of replication of copycat behaviour on the part of viewers. Linked with these issues are others like the dissemination of positive role models (say, of women or blacks), and the extent to which these can counterbalance any alleged harm caused by stereotypical sex and violence. There is also the important distinction between fantasy and realistic violence, and whether viewers can safely be left to make the distinction for themselves, and, if not, how far media management is paternalistic.

One of the most important critical approaches to censorship is that which argues that pornography objectifies women. Often, it is alleged, pornography predicates a male viewer, a voyeur, often sadistic, asserting control in a one-sided virtual or real sexuality which degrades women and their representations. As Helen Longino says, 'Pornography is material that explicitly represents or describes degrading or abusive sexual behaviour, so as to endorse and/or recommend the behaviour as described.' This endorsement arises, according to Angela Carter, because women are objectified within an essentially misogynistic society, which has its roots in a patriarchal view of gender roles. Pornography is also a deceptive activity, because it exploits every experience in people's lives that 'imprisons sexual feelings – pain, terrorism, punishment, dread, shame, powerlessness, self-hate – and would have you believe that it frees sexual feelings. In fact, the sexual freedom represented by pornography is the freedom of men to act sexually in ways that keep sex a basis for inequality. (Kimmel). So, paradoxically, works like *Tropic of Cancer* release sexual feelings but also imprison the objects of sexual interest in a set of powerful, and usually misogynistic, compulsions. The sexual subordination of women has had a number of articulate advocates in recent decades, and deserves examination both for the actual products which emerge for popular consumption (like videos and advertisements) and also for the underlying ideologies (such as the institutionalization of inequality in society and how violence contributes to it). A variant approach of equal value and interest is to examine how far the hegemonistic value-system undermines and indicts any way of life which may be regarded as deviant. Hence the case that much pornography is not only misogynistic but also homophobic.

The critic is in the frame

Subjects like censorship and pornography get enough exposure to induce cynicism. It can easily be regarded as 'much ado about nothing' by 'live and let live' liberals. Then cases like James Bulger and *Piss Christ* and *Satanic verses* appear and the menagerie of arguments and prejudices gets let out to roam through the airwaves and journalistic columns. This is in part due to what Judge Brennan called the prurient interest. But it is also deeper than that: it taps archetypal veins in society and in our individual psyche about right and wrong, good and bad, cleanness and dirt, love and lust, male and female, parent and child. It reminds us once again that the energy of love can become violence when taken to excess, that nudity presented as a commercial spectacle is exploitation, and that great works of art and literature can encompass the erotic without being pornographic. Time and time again, issues emerge which compel us to re-evaluate our moral perspectives, and even provoke us to moral indignation, that*saeva indignatio* which impelled the Roman satirist Juvenal. One such event was the report in the papers in 1993 that car companies were using human corpses in car crash tests, and paying relatives between £80 and £750 per body.

Another factor which keeps the subject fresh in our minds is that new forms of information flow come into being, presenting new social and moral challenges. One of these is pornography on satellite television. Another is computer pornography. This occurs when obscene or indecent images and sounds are stored, transmitted or viewed using computer technology, and of current concern are children and their access to this material. Unlike films and videos, computer pornography eludes control and classification, and it is a form of trans-border data flow unobserved by customs and excise. The police are seeking to define transmissions via telephone line of computer pornography as imports, which would make them eligible for confiscation. Many argue that children can be lured into playing pornographic games (e.g. ones where children's heads can be superimposed on adult bodies on screen), and manipulated by paedophile rings. Linked with violence, these forms of electronic pornography are regarded by many as particularly vicious.

It could be said that the easy availability of information has become a virtue and a truism of current times. The global village creates, disseminates, retrieves and consolidates information like news in ways never seen before, and activities like computer-assisted journalism have transformed already fast-changing media infrastructures. But the easy availability of this information does not relieve us of the responsibility for deciding what it represents, who has generated it, with what audience in mind, and what are its intended and likely effects. Some are economic and political, like its likely effects on indigenous media and publishing operations, and some are normative as well, like the distortions arising from cultural imperialism and hegemonistic media structures which marginalise national cultures. Included in this area of norms and economics is the complex domain of moral and literary censorship and its cuckoo-child, obscenity and pornography. The study of this obliges the student to be multi-disciplinary: law, morality, religion, sociology, psychology, literature, art. It obliges them to look at works in their period, and review the various aetiologies for censorship that lie behind the law suits and critiques and scandals. Such a student has to place himself or herself deliberately in the frame, for such study is self-reflective: he or she is there as a man or woman of their age, with their own refracted self-concepts and stereotypes and prejudices and aspirations, their own agendas for personal and professional development, and their own thresholds (dogmatically realized or merely inchoate) of morality, decency, and taste. Such research, then, aims to exteriorize many of the implicit meanings – about morality, sexual identity, violence, and our social milieu – and subject them to rigorous and honest examination.

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Internet: strategic issues for libraries and librarians – a commercial perspective

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Paper presented at the Dawson Research Seminar at the University of Loughborough, 22 September 1994.

It is twenty-five years ago that the primary network, from which Internet has evolved, was created by the US Department of Defence, when it laid down the Advanced Research Project Agency Network: ARPANet.

While the initial public investment was clearly motivated by military consideration, Internet now encapsulates the world, serving as the conduit for the dissemination of the wisdom and products of our Western culture. It is no coincidence that in parallel with the globalization of the Internet in the past five years, the imagination of the public mind has been conditioned by the media to the opportunities of the synonymous information superhighway, and the commercial opportunities that it will bring.

I sense that the evolution of the Internet will proceed through the usual phases from the unmanaged wilderness at present roamed by the academic explorers, to the landrush, followed by rationalization tending to monopoly, to national government supervised supranational monopolies managing the superhighways and their associated real estate, in partnership with a limited number of carriers offering passage.

The economic importance of the information superhighway has captured the minds of governments: having contributed to the election of Clinton and Gore it now features on the agendas of summits. The European Union Summit in June 1994 in Corfu considered the Bangemann Report on a high performance broadband network for Europe. The superhighway will feature as an agenda item when the G7 meet in February 1995.

Some argue that the Internet 'free ride' is almost over. The Internet has come of age and is about to enter the 'enterprise culture'. The managed landrush has begun. By the Spring of 1995 the 'main lane' of the Internet in the United States will be privatised following the transfer of responsibility from the US government funded National Science Foundation (NSFNet) to four privately run network access points (NAPs). The four NAPs are Pacific Bell, Sprint, Ameritech and Metropolitan Fiber Systems, each with five year franchises to compete with each other to carry the Internet traffic. As Roger Taylor, executive officer of the NSF's networking division said: 'The government doesn't need to be in the business of running a commodity data service when there are private firms ready and able to do the job'. Commercial use of the Internet accounted for more than 50% of all traffic in 1993 and continues to grow at an explosive rate.

NSFNet was the demonstrator model which has convinced the private sector of the value of the market. NSFNet was created in the mid 1980s to link US universities. Soon both foreign and commercial networks connected to the NSFNet which became the global fast lane. In 1993 US taxpayers spent $11 million to run NSFNet, in essence subsidizing a global and evolving commercial network.

What will result is inevitably both positive and negative. For those looking to the Internet as a place to set up a stall, profit driven investment by the highway owners will ensure sufficient capacity to enable shoppers to ride the highway in comfort and park at ease. Those motivated by the view that the right of access to information must not be inhibited by price will inevitably depend on the willingness of the public purse to pay the market driven price through subsidy. The dilemma of the 'haves' and the 'have nots' in an enterprise culture will be with us on the superhighway. The information superhighway is not unique in history – the metalled roads of the eighteenth century and the rail roads of the nineteenth century were not free to ride.

Libraries will have to compete alongside other information providers for access to the real estate of the highway. While the real estate may be virtual it will have a real value and consequent price. That value will be determined primarily by our prospective virtual neighbours: the virtual shopping malls, virtual banking, the virtual games parlours, the virtual betting shops, the virtual fast food menu, the virtual entertainment emporia: their owners will be the giants in the high street; some might be public spirited as were some of their enterprising predecessors, in renting space on behalf of the public information service: the twenty-first century equivalent of the Carnegie Free Public Library.

The purpose of the highway is twofold for the investor in its building and maintenance, the value of the real estate and the value of the revenue to ride the highway. Many of the carriers have already signed up, offering monthly season tickets.

The library will not simply be competing for real estate space and for the right of an audience; it will be competing for the multifaceted form of its current existence as a custodian of knowledge, a disseminator of information and a leisure service. The library's prospective competitors are its current allies: the library service utility, the publisher and the author. The library must not simply find the price of access to the real estate, it will also have to compete for its community of users. Some of those users may not be able to afford the ticket to ride.

Change creates uncertainty and inevitably challenges cherished values. One such value, cherished by most in the library profession, is encapsulated by Karen Nadder Lago, an MLS candidate at the Syracuse University School of Information Studies in an article in Internet Librarian (October 1993): 'Access to information of our own choosing and for our own needs, available in all forms, on all subjects and from all sources, is a crucial component to the perception, understanding, and fulfilment of our lives. The opportunity exists today to facilitate this effort by making available to the public – free of charge – a new technology capable of flooding the world with light.' An up-to-date expression of a philosophy which brought many of us to the profession. While the ambition is laudable I doubt it to be viable in the new enterprise culture that now grips the minds of the politicians of most of the world.

In that research study published under the title: 'Libraries and the Internet/NREN Perspectives, Issues and Challenges' edited by Charles R. McClure, William E. Moen and Joe Ryan (Mecklermedia Corporation, 1994) John R. Garrett contributes a thought provoking chapter: 'Who will pay? What will it cost?: libraries and the economics of networked information'. Garrett asks where the money will come from and answers:

> not from traditional library budgets, which are already stretched to accommodate the just and just-in-case expectations of their users;
>
> not from reduced costs, either from unrealistic attempts to supplant traditional publishers with untested alternative models, or through savings in print and paper;
>
> not from government, either, except perhaps to defray some of the initial infrastructure costs, nor from investment (except in infrastructure) by large corporations, without the certainty of profit; and
>
> not, indeed, from anywhere except the library and the user communities themselves.

This may require [the profession] to reassess some cherished hopes and dreams about libraries, perhaps the very dreams that led librarians to this unique demanding profession.

This conclusion may equally be described as 'clogs to clogs in five generations' for the profession. Its only salvation is to seek new alliances, to demonstrate leadership in demand for public resources and to engage in re-engineering the profession to serve the new environment.

The Internet is a partnership by consent between the burgeoning number of networks (25,000 worldwide in January 1994) and 3,400,000 hosts (July 1994). This consenting partnership offers access to more than 30,000,000 users plus another 15,000,000 accessible through gateways (and growing) worldwide. While the customer community is attractive, the anarchy of the environment and the unequal investment in bandwidth/capacity throughout the Internet world diminishes commercial opportunity and interest. This represents a real dilemma: connection by consent is without obligation and eschews management. Management is necessary if the Internet is to emerge as the global information superhighway capable of graduating from a global e-mail facilitator to an interactive multi-media facility. A managed network costs: to maintain capacity; to manage the resources and services disseminated; to secure intellectual property rights; to protect property rights and payment exchange mechanisms – note the current interest in encryption – and to afford the necessary hardware and software to connect. As gatekeeper to the end user, the library will be required to pick up the tab; if they cannot then riding the superhighway will be partial, depending on one's ability to pay. So, what's new about that! Some might argue that the Internet has been snatched from the hands of its architects, the not-for-profit education and resource community, and has consequently lost its virtue.

Each day we see articles in the media describing imminent multi billion pound and dollar investments: under banner headlines such as 'Heseltine driven down £15 billion information highway' we are told 'The powerful all party Commons Select Committee on Trade and Industry will this week call for a rapid start to the setting up of a nationwide, £15 billion information technology 'superhighway' to deliver services like videos down the telephone line... to be completed in five years'! (*The Observer,* July 1994). The investment will only be pledged by BT on its terms: deregulation – to enter the entertainment business. To build such a national network is estimated to cost about £10 billion – the cost of the channel tunnel. Investors will inevitably look to the entertainment industry, the retail industry, and the productivity benefits that will accrue to commerce and industry, to realize return. Little mention is made of the public interest in information provision.

Entertainment dominates the rush of investment in the development of the highway and the vehicle by which we will travel: the interactive television.

'Disney, Ameritech, Bellsouth and Southwestern Bell form partnership to provide video services (movies on demand), interactive home shopping, educational programs, games and travel assistance over 50 million telephone lines in 19 states' (*New York Times,* August, 1994).

'Hughes Communications plans to invest $3.2 billion in a global system providing high-speed interactive data communications and video telephone services. "Spaceway" will give the vast majority of the earth's population access to an interconnected global information superhighway by the year 2000 (*Investor's Business Daily,* January 1994).

'Sun Microsystems and France's Thomson Consumer Electronics are to jointly build and market products to deliver interactive television, home shopping, education and other interactive media' (*Information Week,* January 1994).

'Compaq expect to market a multi media PC priced below $1,000 in 1995'. This is expected to include software to simplify multimedia functions, such as playing music on the CD-ROM drive, talking on the phone, and pulling TV pictures onto the screen (*Wall Street Journal,* September 1994).

The information service utilities, publishers and librarians will have to be satisfied with the coat-tails of these initiatives. But for some that prospect is worrying. In the United States there is currently a debate upon the planned National Information Infrastructure (NII). While it is apparent that a national information infrastructure is a top priority of the Clinton administration, the partnership to achieve this goal is viewed by some as an unholy alliance. While librarians recognize the importance of the Internet and its likely successor the National Research and Education Network (NREN), exactly how this new service environment will impact on library services is still unclear – there are many significant issues yet to be addressed and resourced by the profession. Yet while this debate ensues fundamental decisions are being taken by competing players which will impact upon the nature of the new environment. Many already observe that end users of the Internet/NREN may only enter through some network service vendor, who makes a charge related either to use or by subscription. To enter also requires investment in hardware and software.

The private sector interest represented by the telecommunications companies, the hardware manufacturers and the media/information industries is lobbying government to establish a two tier structure to support their national information infrastructure, the first tier to provide for publicly funded research and development (what Internet was originally about) and the second tier to provide for commercial communications services controlled by the private sector. This is the motivation for the privatization of the NREN. There is no mention of the third sector, which has started to evolve through the instrument of the Internet, the non profit information communications sector including libraries, particularly the public library sector. This reflects a failure by the library profession, at least in the United States, but I also sense elsewhere, to influence the public debate or more particularly the political debate upon the National Information Infrastructure. The library community must be able to articulate its vision of the evolution of its national information infrastructure. In doing this it must awaken the interest of its user community by reconceptualizing the library to exploit the resources that a national information infrastructure facilitates. Those most successful in capturing the hearts and minds of the end user will establish their right to a stall along the highway.

To travel the highway will cost, and there is real evidence that users are willing to pay. A recent Deloitte & Touche market survey in the United States concluded that most people are willing to spend about $25 per month 'to ride the information superhighway to access (and pay for) movies on demand, home shopping, video games, interactive television, living room gambling and education'. The emergence of the multi-media PC which will ultimately displace the domestic television will not simply provide the vehicle to access the virtual shopping mall or the virtual movie emporium, it will offer access to multi media information sources including those managed within the virtual library.

While I agree with those who argue that it will be a long, long time before digital information technologies fully replace our paper based systems, I would argue that for some aspects of the traditional library service we are witnessing a revolution: reference sources and the journal are undergoing fundamental change and the audience to whom these services are directed are becoming enfranchized. The traditional gateway function of the library to develop, design and co-ordinate an environment to provide intellectual access to recorded knowledge is being undermined as is the in the past unchallenged view that collection development in an academic environment should be determined by a 'just in case' philosophy. The more affordable alternative 'just in time' philosophy is enabled by the developing national information infrastructures. New profit based associations are developing to provide the 'just in time' services. The universal nature of access to the network enables the end user to exercise choice, to purchase directly the service or to enter the gateway of the library to access a budget-constrained range of journals and reference services. The development of full text based electronic services allied with comprehensive abstract and indexing services online, offer the imminent prospect of a comprehensive reference resource and journal collection unrivalled by any library in a form more flexible than its printed on paper form. A new partnership is emerging to realize this new form of delivery. The partnership includes the journal publisher, the reference database producer and the library utility acting as facilitator. The services will be offered in a seamless communications environment driven by powerful search engines and accessed through multimedia personal computers with graphical user interfaces.

In November, 1991, OCLC published its strategic plan 'Journey to the 21st Century' in which it defined its strategy to realize its expressed goal to: 'Provide information to people in a form they want, when and where they need it, at a price they can afford.'

As we approach the 21st century, the electronic medium will increasingly become the medium of choice for an increasing number of people who will create, organize, store, access, retrieve, and distribute information in electronic form.

Scholars and research scientists will use the medium to transform ways in which information is acquired, used, and shared in the conduct of research. From his or her workstation, the scholar will communicate with peers, consult databases, transmit or analyze large quantities of data, and manage personal libraries.

Teachers and students will use the medium to augment the classroom and textbook, with a shift from the passive printed page to the interactive electronic screen that could pose or entertain questions, provide or analyze answers.

Writers, editors, and publishers will still create and produce books and journals, but the pattern of use and production will gradually shift to favour the faster and more powerful methods afforded by electronic means.

People will be looking for smaller and smaller needles of information in bigger and bigger information haystacks. They will send more and more documents by FAX or by online systems rather than by mail.

The holdings of libraries – books, journals, maps, manuscripts – will increasingly exist in electronic form. People will enjoy the option of consulting the printed or electronic page. Increasingly, they will use library services without having to go to the library. The role and dominant characteristics of the library will change, and the library supplier must change as well.

The possibility of the electronic medium will also create demand for new services, both from libraries and from suppliers. There will be an increasing need for effective access to a variety of new information sources – bulletin boards, online data, video and sound data, and electronic publications of all sorts. The gradual shift from paper to an electronic medium that incorporates data, moving images, and on-demand delivery will pose major challenges to publishers, to information users, and to libraries.

Although powerful networks will afford ubiquitous end user access, that access will be neither universal nor sufficient. Indeed, librarianship will require a new breed of electronic information specialists who will have to reinvent for the new electronic environment the traditional library functions of cataloguing, archiving, and providing access to information.

How these needs will be met in the 21st century cannot be forecast with precision. The specifics will depend on the future pattern of technological and economic developments. Much research will be necessary. Success in such a rapidly changing technological environment will require flexibility and agility.

OCLC intends to pursue two complementary strategies in the latter years of its journey to the 21st century. The first is an organized and orderly process of adding enhancements to OCLC's existing base of products and services. The second is an organized and orderly process of adding new products and services.

Towards effective utilization of university library resources: the situation in University of Cape Coast, Ghana

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Abstract
University libraries acquire book and non-book materials to support their instructional needs and research programmes. This explains why various library services have been developed to promote and facilitate effective use of recorded information in all formats by users. This paper examines the services offered by the University of Cape Coast (UCC) Library which include collection building, resource-sharing, conservation, user education and technical services. Others include registration, circulation, library publications, reservation, reference, current awareness and library regulation. It is concluded that, in spite of limited resource allocation, UCC Library has made systematic efforts to offer effective library services to its users.

Introduction

University of Cape Coast (UCC), Ghana's third university, was opened in October, 1962, as a University College in special relationship with the University of Ghana.

By an Act of Parliament[1], UCC was constituted into a full-fledged independent university to confer its own degrees and other academic distinctions in October, 1971. The Act also assigned UCC the unique role of training graduate teachers in Arts and Science for the country's secondary schools, teacher training colleges, technical institutes and polytechnics. Education is, thus, a compulsory component of the undergraduate studies.

The university has five faculties namely Arts, Science, Social Sciences, Agriculture and Education. All faculties offer programmes leading to Masters and Doctorate degrees. It operates the semester and course unit system.

The University of Cape Coast (UCC) Library

This library was established by a Ghanaian librarian in 1962 with an initial collection of about 650 books. These books were transferred from the erstwhile Kumasi College of Arts and Education, now University of Science and Technology[2].

The collection was first housed in one of the lecture rooms in the Faculty of Arts. In April, 1963, the Library was moved into a temporary building with a capacity for 40 readers and 20,000 volumes[3].

The Library comprises two divisions – the main library and the science library – which are separately housed. The former houses books and other materials on Arts, Social Sciences and Education. Library resources on Science and Technology, Agriculture and some aspects of Medicine were moved to the top floor in the Faculty of Science building during the 1967/68 academic year. This was done to complement the inadequate space in the main library, and also to have the science books as close as possible to their users.

The two divisions together contain a total of over 180,000 volumes at September, 1993[4]. This excludes pamphlets and journals. The Library uses the Library of Congress Classification Scheme with modifications to suit local needs.

There are faculty/department and hall libraries, which are either manned or supervised by staff from the main library. The most important ones are the Faculty of Education collection, which is being developed into a library and documentation centre on education. Others are, the libraries of the French, English and Geography Departments.

The staff position of the library (both divisions) during the 1993/94 session is as follows: 11 professionals, 6 para-professionals, 6 secretarial and administrative staff, 143 junior library assistants, 2 photocopier operators and other auxiliary staff. The current staff strength is inadequate considering the range of operations, services provided by the Library and its total workload requirements.

Library services

The major obligation of the University Library, which is regarded as the pivot around which the educational and research activities of the university revolve, is to provide materials and services to fulfil these functions. In general, the library undertakes certain tasks, namely, acquiring, processing storing, retrieving and disseminating, the sum total of which goes to achieve the functions, aims and objectives for which the university has been set up.

The specific services provided by the UCC Library order to ensure maximum utilization of its resources are:

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Collection building

Over the years, the Library has built a valuable collection which includes required and assigned reading, reference and bibliographic materials, basic journals and serials. Other library materials which students and faculty members are expected to consult regularly in course of their academic work or in writing their long essays, theses and dissertations have been acquired.

The Library materials, which contain all varied forms of recorded information (books, journals, microforms, tapes and slides), have been carefully selected and acquired with the aid of academic departments. The library not only purchases these materials but often acquires them by gifts, donations and exchanges. It also relies on foreign embassies and other benefactors like the British Council, Overseas Development Administration, with the result that 'large collections of books, whatever their worth have found their way into the library'[5].

Under the Book and Newspaper Registration Act[6], university libraries in Ghana are depository libraries. Thus, UCC Library is expected to receive a copy of everything published in Ghana except government publications. It also attempts to obtain materials on Ghana wherever they are published. UCC Library is also a depository for the publication of the United Nations and its specialized agencies like UNESCO and FAO.

Acquisition of materials by the Library is hampered by inadequate financial resources allocated to the university in general and the Library in particular. It is to be noted that the collection is reviewed periodically to ensure its relevance to users' needs.

Research-sharing

With the increase in the number of researchers and academics, and the mounting cost of books and journals, the Library has adopted various methods of inter-library co-operation to supplement its resources. Resources-sharing is carried out in collaboration with the four sister universities and special libraries of Ghana's Centre for Scientific and Industrial Research. It also relies on other local and foreign libraries, especially the British Library at Boston Spa. During the 1989/90 academic year, the Library participated in the publication of a Union List of Serials.

The Library also encourages its own registered users to make direct use of the resources of other libraries by issuing letters of introduction to them. It observes that co-operation is not limited to inter-library lending. Its librarian and senior members meet with colleagues from other universities from time to time to examine solutions to common problems.

Conservation

UCC Library is a custodian of library materials and other rare collections. As an academic library, it conserves the valuable collection it has built over the years. Some amount of activities are, therefore, carried out to ensure that the holdings enjoy a longer life-span. These are the acquisition of air-conditioners, provision of minimum storage facilities, adherence to good housekeeping practices and fumigating/insecticiding the collection at regular intervals. The library has a 'small' bindery facility which engages in some restoration activity and binding of library books, periodicals, theses and dissertations.

User education

UCC Library organizes user-education programmes as part of the general orientation activities planned to introduce newly-admitted students into the university. The aim of such a programme, organized by the Librarian or his representative, is to introduce these students to the university library or to improve the students' competence in the use of library resources. The students are grouped according to halls of residence during this exercise. User education programmes in the Library are started by spelling out the history of the Library, resources, facilities and services available. This is followed by a guided tour of the Library, which is meant to teach students some practical aspects of the Library. These include the use of catalogues and other basic reference and bibliographical tools. After the tour, students are registered formally at the issue desk, thereby granting them unimpeded access to the Library.

Unfortunately, the desired objective of this programme has not been fully achieved due to a number of factors. Among these are the large number of students involved, duration of the exercises (just an hour or two), timing of the programme (normally within the first two weeks of the academic year when students are preoccupied with adjustment and general university life), and inability to extend this to other students who are admitted later. As a follow-up of this exercise, however, the library teaches a three-credit full course, namely, the Information Retrieval Course (IRC 301) to all third year students. The course helps students to use library resources to produce good term essays and other scholarly works.

It is to be noted that the Library organizes user education programmes for other members of the university community upon request.

Technical services unit

The library has a good collection of equipment such as telex, photocopying machines, microfilm and microfiche readers, to support its work. An IBM personal computer with a memory of 640kb was installed in the air-conditioned section of the library in 1989. Another one was installed in 1993. These two computers have aided information organization and retrieval even though readers do not have direct access to them.

The photocopying service aims at encouraging users to make copies of reserved materials, rare collections of journals which are not lent out. This service is provided within the copyright law, and the fees charged are very reasonable. Thus, the photocopying service is not only meant to save library materials from being stolen or mutilated, but also to promote effective utilization of the library's resources.

The Library again recognizes this service as an extension of inter-lending, and, therefore, acquires copies of titles and other articles from journals held by other local and foreign libraries. During the 1991/93 academic years, the Science Library alone received sixty-three photocopies of articles found in various scientific journals from the British Library Document Supply Centre at Boston Spa[7].

Registration of readers

Registration is extended to all new members – faculty members, students, researchers, senior university administrative and technical staff, library staff and university employees who are recommended by their Heads of Department. All users are required by library rules to present identity cards or letters of introduction before they are registered and allowed to use the Library's resources. After the registration procedure, the user is provide with borrowing ticket(s) and a copy of the current library guide. This guide provides information about the Library's resources and facilities and how to make maximum use of them. In the case of students, registration is valid until they complete their courses. University staff cease to be authorized users of the Library when they are no longer in the employment of the university.

UCC Library does not consider its services as being exclusively confined to members of the university. As is pointed out, 'members outside the university who would normally use school, special or public libraries have turned to the university library for help for obvious reasons'[8]. The Library, therefore, allows access to other users apart from members of the university. Such external users, who are normally admitted at the discretion of the librarian, may be required to pay a refundable deposit of ₵3,000 and an enrolment fee of ₵1,000. External users include, lawyers, graduate teachers, agriculture/forestry officers, senior government officials and other professionals.

Circulation

Some of the Library's collections are readily available for consultation in the Library. Many others are lent out to authorized users within the context of the Library's purpose, aims and objectives. Terms of loan and access to its collections for all categories of users have been spelt out in the 1993 Library Guide[9] as follows – academic staff may borrow up to ten books at a time for not more than one semester. Books must be produced for checking at the end of each semester, and must be returned if requested by another user. Senior administrative/technical staff may borrow four books at a time for two weeks, renewable for a further two weeks. Junior staff of the university, who have been admitted as readers on the recommendations of their Heads of Department, may borrow up to two books at a time for two weeks. They may renew the books for a further two weeks.

External borrowers, who have been duly registered after paying the necessary deposits and fees, may borrow up to two books at a time for two weeks, renewable for a further two weeks. It is to be noted that no reader may renew a book for two consecutive periods without an application to the librarian.

The Library imposes overdue fines on users who unduly keep library materials beyond the stipulated loan period. The rate, which is reviewed periodically, is currently ₵20 per book per day. Overdue fines for books in the reserve collection and students' reference collection is ₵100 a day. Other penalties include the denial of further borrowing unless all overdue books are returned and any fine incurred paid. Further, the university does not release examination results of students who fail to return library books or pay overdue fines.

It is a policy that students who complete their courses, people who cease to be employees of the university (through retirement, resignation, dismissal etc.) should obtain clearance from the Library before they leave.

Library publications

The Library regularly prepares some publications like library guides, accession lists/library bulletins, annual reports and other periodicals to be consulted by users. Selected bibliographies on the various subjects are also produced. The motive behind such publications is to help users become aware of the stock and other resources available in the Library. These no doubt help in the optimum utilization of its resources.

Reserved system

Some recommended books are withdrawn from the shelves and kept behind the circulation desk upon request from the academic staff. The Library occasionally withdraws books that are frequently borrowed and are placed on reserve. All such reserved books are available for use in the Library only. Users must return books borrowed from the reserved collection to the library assistant at the issue desk before leaving the Library. Thus, there is some sort of closed access to this collection, and the rationale is to make it possible for all users to have access to them.

There is another side of this reserved system. If it is found out that a particular book has been borrowed, a user who also needs it is required to fill a reservation form. The Library then collects the book from the original user. The user, who puts in the request, is then notified and asked to collect the book within 24 hours.

Reference section

Apart from providing reservation services, the Library maintains a Reference Section. This section comprises the students' Reference Library, which contains multiple copies of textbooks and standard works, a sizeable collection on Ghana and Africa as well as materials on current issues like AIDS and world affairs.

The section also stocks a variety of dictionaries, handbooks, manuals, yearbooks, directories, bibliographies and encyclopedias. Rare or special collections are also kept and access to these materials is restricted and allowed under strict supervision. Even though all items in the Reference Section are to be used in the Library only, academic staff are allowed to borrow some of them for a very limited time. This facility is granted on application.

A reference librarian receives enquiries from users and assists them to make use of relevant publications in the Library. A tour of this section is also arranged upon request from all categories of users.

Other services

Among others, the Library provides adequate and comfortable accommodation and fixes liberal and flexible hours of opening. It also makes and enforces basic rules and regulations that will safeguard the library stock and other facilities. These library rules and regulations and other general information are written in the Library Guide, copies of which are given to authorized users. It is to be noted that defaulters are dealt with in accordance with the statutes of the university.

The Library operates a Selective Dissemination of Information service, by which faculty members and postgraduate students can request to be kept regularly informed of references to written materials in their fields of interest. Users are also notified of current materials the Library has received by displaying such materials near the circulation desk. These items are integrated into the general collection after some time.

There is also a Library Board, on which the Library, the University Bookshop, Faculties, the University Administration and students are represented. This Board advises on matters pertaining to the Library's budget and policies for collection development and use. It also assists the Library to improve its services and facilities so that users' requirements can be met.

Labelling of all sections of the Library, including the stacks, has been carefully carried out to enable users to operate effectively.

Author/title and subject catalogues have been placed in the Library, and these afford users adequate access points to the collection. Thus, users are able to locate and retrieve publications that are of interest to them.

Conclusion

It is often stated that within the context of the university's educational purposes, the Library should be well-funded, well-stocked, well-staffed and well-equipped to ensure its maximum use. The University of Cape Coast recognizes this important assertion. It, therefore, ensures that the library has adequate and appropriate staff, financial resources, physical facilities, collections and services to meet its stated purposes, goals and objectives.

Unfortunately, since 1980, yearly allocation of funds to the university and the proportion of this budgetary allocation to the Library by governments of Ghana have fallen far below their funding requirements. This phenomenon has come about as a result of persistent economic recession and falling commodity prices – a characteristic of almost all developing nations, including Ghana. Thus, building the library's collections in particular and developing its other essential units in general are adversely affected.

Alemna (1990) observed this about collection development in universities of Ghana – 'every good collection is an expression of adequate and sound financial backing, and no collection development can achieve this objective if it is financially handicapped'[10].

Inadequate funding has, indeed, affected UCC Library in a number of ways, First, the new Library complex, which was started abut fourteen years ago, is still not completed. Payment of subscription rates in respect of current journals and other vital publications are either delayed or not made at all. In most cases, materials and equipment supplied are inadequate considering the amount of work and number of users involved.

In spite of this setback – limited financial resources – described above, the University of Cape Coast Library has made conscious efforts at providing effective library service.

On the part of its users, they have been very cooperative in making use of the available resources.

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Perceptions of copyright in a group of UK information scientists

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Background

This paper is based on an empirical study of the working habits and perceptions of a specific group (academic information scientists in the United Kingdom), summarizes their comments on copyright, and those of other interested parties (publishers, librarians, rights groups, lawyers) and discusses the implications of what was observed in the context of the law and the literature on the law at the time of the field study.

The focus of the empirical study was the impact of new media on journal publishing, with information science in the UK as a case in point. The author presented publishing as an industrial system which could be modelled in terms of five stakeholder groups (producers, consumers, publishers, regulators, funders), whose perceptions and interests were recorded (Davenport 1992, 1993A). The approach taken was purely qualitative: the comments of the producers/authors who were interviewed (twenty-five academics in the four most highly ranked research institutions at the time of the study and three consultants) were coded and classified to produce a profile of perceptions of property rights in the group under observation.

The legal framework

The principal legal instrument for the enforcement of intellectual property rights in the United Kingdom is the 1988 Copyright, Designs and Patent Act (Great Britain, 1988) and various appendages like the Prescriptions for Libraries, August 1989, in the UK and the US Copyright Act of 1976 (U.S.C. 17). Three of the categories of the 1988 Act are relevant to electronic texts – protection of literary works, protection of cable programmes, and protection of compilations (within the category of literary works under the 1988 Act). The rights which attach to the first are the right to exploit one's work for financial gain, and the moral rights of paternity and integrity – both of which may be challenged by the manipulation of electronic text. 'Copying' includes storing in a computer.

The 1988 Act poses several problems: the first is ambiguity of definition (Dworkin, 1989). Just what is covered by which protection mechanism is unclear: some state that paternity and integrity do not apply in the case of compilation and cable programmes. And it is unclear where new electronic formats fit in the categories offered: should a bulletin board discussion be protected as a compilation, for example, in addition to the protection of its separate literary components? A second problem area is the time frame for protection: given the ephemeral nature of much material on networks, it is unlikely that much of the material accessed will be out of copyright, and tracking the whereabouts of owners who may shift from institution to institution may be paralysing: explicit statements of waiver, or other contractual arrangements are, understandably, a notable feature of existing e-journals.

International instruments must also be acknowledged. The first is the Berne Convention for the Protection of Literary and Artistic Works (Paris Act, 1971) – both UK and US legislation (by an additional instrument of 1988) conform to this; the principles of national treatment (protection extended to foreign products on the same terms as domestic ones) and independence of protection (this extension is independent of the protection enjoyed in the country of origin) are outlined in this convention. A memorandum of the World Intellectual Property Organisation (WIPO BCP/CE/1/1/, 1991) which appeared at the time of the fieldwork considers a possible protocol to the Berne Convention which will cover the legal protection of databases.

A further international instrument is the European Commission Draft Directive on the legal protection of databases, which at the time of writing (European Commission Press Releases, 1993) sought to 'establish a basic harmonised framework' for legal protection across member states; prior to the draft directive 'the same database could be protected in some member states and not protected in others, or protected not as a database but as a different type of work' (2.2.5). The legislation of member states serves to protect collections or compilations of works or other material by copyright either as works under article 2.1 or as collections under article 2.5 of the Berne convention, 'but it is unclear whether in all cases such protection extends to databases and to electronic databases in particular' (2.2.8). Oppenheim (1992A, 1992B, 1993) maintains that the Directive clarifies the legal definition of databases (as literary works); its latest draft also maintains the rights that attach to 'fair use' while opening up the market for third party products and services.

The 1976 US Copyright Act is relevant to UK work published in the United States: this offers explicit protection for both compilation and content (the latter is covered as a literary work): a compilation is a work formed by the collection and assembling of pre-existing material or of data that are selected, co-ordinated, or arranged in such a way that the resulting work as a whole constitutes an original work of authorship; the copyrightable element of the compilation is the material contributed by the author of such work as distinct from the pre-existing material employed in the work. The definition of what is protected is more explicit about the means of production and reproduction than that offered by UK legislation: 'Copyright protection subsists...in original works of authorship fixed in any tangible medium of expression, now known or later developed, from which they can be perceived, reproduced, or otherwise communicated, either directly or with the aid of machine or device'. (17 U.S.C. Section 102 (a)).

Rights issues

A major issue in rights debates is appropriation: who, as a result of owning the rights, is a potential beneficiary? Much of the discussion is coloured by existing publication practice – for many participants the phrase 'electrocopying' refers to a hybrid environment where printed material which has been stored is downloaded; in this environment (the world of the traditional production process) authors are likely to have assigned their rights to publishers and credit is symbolic rather than material. In the UK, a Royal Society sponsored project is currently looking at the possibility that research councils, in return for providing funding to research projects, will retain copyright in the published results (Royal Society, 1993). This will enable them to influence decisively the terms upon which results are released to the academic and research community.

A second issue is the level of aggregation at which rewards are made: should this be collective or individual? A review of the UK Copyright Licensing Agency (CLA) in the Bookseller (Anon., Bookseller, 1992) describes it as a 'banking operation with legal overtones'. The Agency's own mission statement (CLA, 1992) states its operating principles as follows: those who create, and those who invest in creativity, should be paid for electronic use of their works; RROs should use their expertise to collect fees where appropriate; computer programs to measure electrocopying should be developed; fees should be determined by market forces; a code of good practice for citing and identifying source material and acknowledgments should be devised; electronic publishing and re-publishing should not be handled by RROs in the near future (they have enough on their hands collecting for photocopying); common international practice should be established. The mission statement includes a review of a number of payment methods including unrestricted site licences (Elsevier's The University Licensing Project, or TULIP), restricted licences (the regime for most online and CD-ROM products), and transactional reporting (as practised by the ADONIS consortium and CITED) (Stern, 1992).

Bradley (1992) states that the principle of collective reward endangers the concept of indiviudal earnings, as it substitutes compensation for earnings. What then is required of an individual contract? Dickens and Feldman (1992) describe the design of viable individual contracts within the existing copyright framework, writing primarily from a UK perspective: the goal for publishers and their authors is to agree upon a clearly delimited grant of rights which will in turn enable administration of electronic media licences as part of a coherent strategy of exploitation of all rights in the underlying work. The Handbook of International Rights (Association of American Publishers, 1991) offers similar advice: the electronic re-uses as well as the specific works to be covered should be set forth in writing. This will resolve such issues as the technology to be used and the publisher's material involved: is the material to be used in combination with material from other publishers, and what medium is it to be delivered in?

A third issue is enforceability. The development of technology which audits the exploitation of electronic text like that piloted in the EC's CITED project may enable royalty to be collected on the basis of specific cases (Long and Neesham, 1993).

A fourth issue is the cost of copying. There are at least two aspects to this: royalty, and the recovery of production costs. The former is generally accepted as an efficient contractual arrangement for the management of transaction costs (Crew,1984). Demsetz (1969) observes that journal articles offer a situation in which consumers vary both in their copying costs and their valuations. He discusses what he calls the valuation-copying cost space, a theme developed by Liebowitz (1985) who concludes that the effects of changes in protection should be related to costs, not levels of copying.

Alternative models for the exploitation of electronic text have been developed by Miller and Drexler (Miller and Drexler, 1988A, 1988B; Drexler, 1991). These use a system of permissions, tied to IDs and interest groups or clubs, to regulate a complex of duties and responsibilities whichallocate resources (processor space, bandwidth) on a contractual basis. The metaphors which convey the economic vision are drawn from genetics, andtraffic and crowd control, and reflect the view of Barlow and Kapor (1990), and Barlow (1994) that 'the old concepts of property expression, identity, movement and context, based as they are on physical manifestation, do not apply succinctly in a world where there can be none'. As the mission statement of the EFF (Electronic Frontier Foundation, 1990) indicates, the search is on for 'new metaphors for community, expression, property, privacy and other realities of the physical world which seem up for grabs in these less tangible regions'.

It may be that the electronic environment is best served by a public good model. Samuelson (1954) describes public goods as not those which are publicly subsidised:a common misconception (see, for example, Okerson (1991)) but those which are non-exclusive (it is infeasible to exclude from the benefits those who do not pay for them), and cost independent (the cost of providing them hardly depends on the number of units consumed). Much of what is currently published on the Internet appears to satisfy such criteria.

M. J. O'Donnell (1992) offers several possibilities for the Internet: the Internet will develop a system of accounting and charges comparable to that of the current telephone system (with access to journals like the current 900 system); in this scenario, charges should be uniform and small, comparable to a modest long-distance call, and they should be cumulated and presented monthly. Alternatively, individual readers may subscribe to general scholarly services at an annual rate determined by broad categories of volume of use; with this model, it is crucial that the number of different services required to cover a given topic be very small. Or larger institutions may subscribe, probably through their libraries, to services on behalf of scholarly staff; and national and international organizations may fund journals with block contracts in return for unlimited access by all of their members; this last scenario suggests that national and international organizations may fund journals from dues and conference events (the flow of funds is in the other direction at present). The idea of site licences is developed by Gherman (1991), who quotes Dowlin: 'The librarians of tomorrow will be better versed at licence negotiation than book choice; in the future, the article may well be the basic unit of academic information for users; we may negotiate a licence for number of discrete items in a named discipline, and print them out'.

The data: some views of practising academics

Author/reader views on rights issues are characterised by indifference. Appropriation was interpreted in terms of excessive publisher profits, even though financial reward was not expected. A senior librarian observed of many of his clients: 'It never occurs to most of them that making money out of the dissemination of their ideas is intrinsic to their financial status', a view corroborated by a senior academic from another institution: 'I think that in general for academic researchers the issue of copyright per se is not really that significant because the copyright is often released to the publisher anyway'. One eminent researcher expressed a similar point of view: 'It's not an issue at all and I'm quite cavalier about copyrights and that kind of thing...I just don't care really, I don't think that what I write, I don't see it as having a monetary value'. Financial issues apart, illicit copying was not seen as a threat. One academic dismissed copyright as 'An absolute non-issue...in practical terms you are protected because people recognise plagiarism when they see it'.

Several of the authors interviewed expressed the view that copyright in the electronic medium was no more of an issue than in the print-based medium. One senior academic observed: 'Property rights? I don't think I worry about them any more in the electronic medium than with things I'd done on paper'. Another academic, who specialises in copyright law, observed that as regulation in the electronic medium depends on license, not sale, it is easy to inhibit those who infringe rights: 'If I'm an electronic publisher and I notice that you're doing something I can just cut you off, just switch you off'. Indifference to copyright is a more serious issue at the institutional level, than at the individual.

Collection

Several librarians observed that their clients operate in a state of ignorance of the law, and thus behave (as individuals) in ways which conflict with institutional or collective contracts. One librarian observed: 'I do see academics as being the major stumbling block on this ...all the academics want to be able to do is to take everything they want at the desk and to an extent...libraries are forced into an awful position of having to stop and be negative and impose the rules...the other area that's hitting me, the whole sort of CLA thing is inappropriate'. An academic who specialises in copyright commented: '...the users are still very ignorant'. She felt that legislation followed commercial rather than moral imperatives (which left the whole area outside the sphere of intellectual influence of many academics): '...the part of the EEC that deals with copyright, just as in this country it's the Department of Trade and Industry, in the EEC, it's the Director General for Competition. They're not interested in libraries and use, they see it entirely as an economic matter'. Whether the CLA exists purely as a sop to the law, or whether it offers an efficient method of disbursing rewards is not clear. The former role appears to be confirmed in contracts like that negotiated with the British Library Document Supply Service which offers a flat fee rate (one which undercuts many of its competitors). The comments of one academic were cynical: 'The Copyright Licensing Agency sort of gathers everyone up and then acts all draconian'. 'What copyright law is really doing is standing in place of those individual contracts. And writing those individual contracts is a disproportionately large effort in relation to the value of what it is you're licensing'.

Two of the consultants were meticulous in their observation of the law as they perceived it, and complained that: 'The whole copyright area has become very cumbersome...We think that the way things should develop is to have a global licensing arrangement where people pay a licensing fee; the way academic libraries do now...no-one knows whom to turn to, who actually has authority, who owns the copyright on material which is in an electronic form or what parts of the law apply'.

Detection/enforceability

Several speakers admitted that they knowingly break the law (the author labels this 'fair abuse'), where it appears pragmatic to do so, or where conformance is perceived to be unjust: 'I don't let the fact that I've transferred the copyright of a paper stop me photocopying it willy nilly if people write off for an off-print'. One speaker, who was punctilious in her own conformance ('Yes. It's something I think about. But, well, I obey the letter of the law. I put one copy in the library and I tell the students they may take one copy') described practice at her institutional library: 'When I go up to the library when the photocopiers are being used I can see there is absolutely no control whatsoever over what is going on and there can't possibly be because there's no staff to oversee it and there's not the resources'. Her colleague stated that the 'free use' of information is fundamental to the research process, and that current legislation, with its emphasis on commercial benefit, would lead to illegal activity: 'The users, the people that put the information in have an interest in free use of the information so that they can create more stuff to put in. If you don't have any recognition of that, if you don't have a loosening of the system it's going to tie itself into an unholy knot.'...'You might as well forget about electrocopying. I think people will just break the law because it's unjust and they can't see the sense of it'.

Such views were supported by the comments of one of the consultants: 'We all work in an environment where we actually condone breaking the law...you put the photocopier outside the door and you say 'I don't want to know anything about it''. He pointed out that the transaction costs of compliance are too expensive for individuals to bear and they will thus take a pragmatic approach: '...people are focused on individual transactions and of course the bureaucracy that's involved in administering that makes it impossible for people to do it, it's just not worth their while'. The problem of identifying the 'substantial part' which constitutes copying was raised by another researcher: 'you can't sort of rely on that sort of identification in a legal sense'...'You have to be able to define things like what is a sufficient similarity'.

Two of the academics interviewed asserted that users with a knowledge of the law could negotiate terms which protect both their rights and academic freedom: 'I think people will eventually realise you don't need to be kicked round by publishers – you can hang on to the copyright of things and then you can exploit it if you want to'...'Perhaps the way is to say that they are in charge of copyright but you have a personal copy, a privileged position actually just to photocopy as much as you like'.

Auditing evoked a mixed response. An experienced academic commented: 'What publishers want is power, they want detailed knowledge of who consults exactly what. There's a control aspect to copyright...(in the electronic environment) you can't control who does what and where it goes however much you want, well I mean, you can, but it costs an awful lot'. Others were less pessimistic: technology for electronic auditing had been proved to work on the ADONIS material: 'What really excites them is the usage feedback', and several players were involved with the EC's CITED project. One academic with a particular interest in copyright observed: 'It does useful market research and it gives you a hint of abuse and very often the contract includes a clause which says..the publisher reserves the right to just walk into your premises and see what you're getting up to...In practice, they don't seem to make much use of it, I've got to say'. One speaker felt that guidelines would have to be provided: 'you can't monitor unless you have guidelines'. Another was uneasy about the surveillance aspects (from the perspective of intellectual freedom rather than non-payment). This speaker offered a libertarian scenario for networked publishing without the publisher: 'On that network you can have free copying and free access with acknowledgment and you don't have to have copyright unless there's publishers involved...the universities as a whole might get together and say 'we put a value on our producers' work and we will not let you just have it and take all''. It may be that a subsidised network is uniquely suited to academic exchange, or the operation of symbolic markets, where credit is measured as credibility not royalty.

One academic raised the issue of marketability in a private economy: some disciplinary areas may be less viable than others. Her comments were made in the context of difficulty in raising funding for an electronic humanities index project: 'If you don't have a variety of different types of databases available for public access, right, then you won't be able to explore what you can do on the networks in this field of humanities...stay in the public domain and I think that would be to the benefit of its potential users'. Another researcher raised the issue of free access to material which one had produced, after handing over copyright to a third party: '...what most academics would find OK is the freedom and the right to use any material that you produced as the result of a funded project and if there's any cash involved in the use of it, to negotiate that'.

The views of other groups

What were the views of groups who participated in the study, other than author/academics? Among those who mediate and regulate access to research material, there was some disagreement about the effectiveness of current legislation to protect intellectual products. The Berne Convention was held by those who see no problem with the law to be the basis of a range of exchange relationships which would satisfy all contenders across all media. One experienced librarian observed: 'Given that copyright as a concept, intellectual property, is a concept that works, there's no reason why it shouldn't apply electronically, and you then follow the consequences through from that'. A consultant who specialises in copyright in the electronic publishing sector observed that existing law offers : 'a reasonable basic set of principles, 'I have created this or I have invested in this, it is mine and you can only consume it, you may not re-sell it'...if you go back to that as a first principle, if you take the Berne Convention as a first principle, you can actually work out what is a reasonable set of relationships.' Even before Berne, English law has accepted the principle that it is wrong to copy. One legal specialist observed: 'English law has always made it an unlawful action to copy without the consent of the owner'. This speaker felt that English Law currently offered an adequate instrument: 'We've been quite good in bringing things up to speed in terms of technological developments...you will need new copyright laws more frequently...the principle is that it is wrong to copy somebody's work...How can you copy someone's work without breaking the law? You can do it with their consent under licence...the problem in contractually licensed exploitation is the ability to find out and police whether the rights they've let control of are being observed'.

A senior strategist from the British Library observed: 'Not so serious a concern; within groups like the UK academic community, I can see copyright being waived. The people who mainly impose copyright constrictions are the publishers. The academics want their papers to go far and wide, it serves their purposes to disseminate their papers, it gives them more status'. An experienced observer could perceive: 'very little infringement of intellectual property... the consumer's almost paranoid about conforming to what are reasonable practices, sometimes they misunderstand but they do have a view that this belongs to someone else – "I'm not going to exploit"'.

One awkward area was moral rights. This speaker was aware of how obstructive the assertion of paternity and integrity rights may be in the production of large, collaborative projects: '*Droit d'auteur*...that becomes increasingly absurd towards the end of the 20th century where a huge area of copyright exploitation is actually dependent on collaboration and on huge investment and on compilation as well'. Even outside such large-scale ventures, these rights may produce rewards which are sliced to an extent that makes remuneration, or other credit, meaningless: 'the environment that made that bit of research...it's beginning to become absurd'. In Britain, moral rights may be waived (and the legal expert insisted that his clients do this on many projects), and the remuneration problem is avoided where royalties are claimed on a collective basis: 'In Britain it's very easy because CLA doesn't concern itself with the distribution to the individuals'. The matter is serious where copyright is claimed on material or products or texts which have no significance in terms of artistic creation: 'Right of public access...a very clear clash between the monopoly right of a copyright owner which is sourced in artistic creation and a legitimate competition concern of society because what you are beginning to see created are works...that are merely tools for industry'. Hence the negative reactions, the legal expert explained, to the European Directive for the Protection of Databases (going through draft stages at the time of the interviews): 'Now suddenly the industry is recoiling in horror because they wanted to be artists when all along they're really retail publishing'.

On-demand extraction

The suggestion (from one experienced observer) that: 'Perhaps the economics of scientific publishing also need changing, where you pay for information at the time of use', was disputed by another consultant: '..you have to re-jig the entire economics of publishing and publishers are not able and not even prepared to contemplate it. They could not make that change...the change in the structure of your revenue is such that the company would almost certainly go broke'. But if, in a more gradualist development, the document delivery market starts to grow, what will it cost and who will be involved? The publishers' calculus is rooted in the status quo: all of the pricing projections provided by speakers from this sector assumed existing turnover and profits as the base. Direct costing from such premises yielded impossible prices for each individual article, which excluded the investment costs of changing the format of databases (to forms of mark-up which might produce readable output, for example), and carrying out market research on the 'end-user'. By restricting their economic modelling to such premises, publishers appear to be presenting contrivedly impossible pricing algorithms, possibly in an attempt to sustain existing print markets. Costing units *per se* are unlikely to be understood by researchers, as one librarian observed: '...academics are not prepared and don't have in many cases money to pay for rather more rigorous... pay as you use... I think they would be very intolerant of a dime a page or something because they're not used to that sort of economics of information'.

Other players did suggest more flexible arrangements which might sustain publisher investment power, while providing feasible access to individuals in academic institutions: if (as indicated above, it is a questionable assumption) electronic delivery is seen as comparable to copying, and if a subscription to an institution can cover 'first copy' costs, then a workable arrangement might be subscriptions which vary across institutions with freedom to supply individuals on demand.

Models: the centralized approach

Several speakers made the point that a critical mass for digital research meant networked publishing ('...the point is that it also has to be combined with a network or else it doesn't work and that's what's wrong with ADONIS'), and two made a strong case for centralized control (with different candidates being offered for the role of primary coordinator). A consultant who has advised many of the player groups on possible scenarios reviewed the options: 'A basic all-centralized system, large document holdings which will fulfil that ultimate request...another model will be a distributive performance system...one is that the library does it...an alternative is that publishers do it...I don't believe in either model, actually...I favour the centralized model...but much more important is how the buck is followed...if it doesn't ultimately go back in some form to the publisher to replenish that database of journal articles, then either something else has to be put in its place by some other player, or else that whole system of article publishing... disappears'. One senior strategic planner from the British Library envisaged a digital publishing centre could support a range of fiscal regimes: 'all sorts of mixes that one could use here and it may be that it has to be done on the basis of price per user ID, so you can buy, an institution can buy in as much as it wants from that, pay a flat fee for the institution, that way we cater for small institutions as well as large institutions...it's going to have implications for budgeting within institutions and between groups of institutions..in the present situation, for example, we have CHEST negotiations on behalf of academic institutions'.

Who would run it? The originator of the strategy was open-minded: 'It doesn't have to be the British Library that has a role in it, it may be that the academic community finds its own solution'.

Most participants suspected that, left to their own devices, a public good economy would suit most scholars. One experienced librarian observed: '...if committees are not there and libraries are not there, and scholars communicate with one another direct, would they want to charge one another? I don't think they would, at least in the academic world'. An interesting gloss on public goods was offered by a legal expert on copyright, who had a clear concept of 'public interest publishing': 'Now the law has always recognised certain exceptions to basic copyright law for public interest...the academic who writes a monograph and puts it straight into a system...he's put it effectively into the public domain'. Such direct input into a network, he maintained, means '...you had given an implied licence for use for private study...In legal terms the act of putting your work onto this database has the following effects: there is an implied licence for anybody else who uses the network to do the following – take one copy for private use, interfere with, amend and adapt it or comment on it and reintroduce it back into the system or make one copy of their adapted work for private use but not for separate publication; any work reintroduced in an updated format can be used by anybody else on the system for the same authorized purposes...nobody would have the right to commercially exploit without the consent of all the people who have contributed the annotations'.

Conclusions

A consultancy report on publishing in the United Kingdom which appeared at the time of the fieldwork (DJB, 1992) concludes that 'there is an ignorance of what each party is doing and a total ignorance of market structures and commercial needs...a need for more and better understanding of the separate subcultures which together make up the UK information industry'. This analysis was confirmed in the author's study. Many reader/users, interpreting copyright in terms of their current paper-based activity, showed themselves indifferent to, or wilfully ignorant of the law, and were cynical about collective provision: the royalties imposed by CLA were perceived as arbitrary, for example. Many endorsed the idea of a public good domain, and some speakers suggested that networked publishing (perceived as far off) might offer a public good economy, which by-passed publishers and libraries. Few in the producer group showed any understanding of the costs of copying. A comparison of the views of different groups shows a clear conflict of value systems. The author suggests that one way to resolve such conflict is to reveal more of the rationale for the stance of a given group, and that electronic dissemination and delivery systems can accommodate such information in the form of accounts of the components of costing, for example.

In this context, two developments in the United Kingdom since the time of the fieldwork are significant. The first is the rapid uptake of the BIDS service, which has demonstrated that a site license which offers unlimited local use can be endorsed by both publishers (in this case of databases) and academic users (East and Tilson, 1993). The second is the Follett Report (Follett, 1993) and its commitment to pilot projects for innovative library services, some of which may address the rights problem.

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